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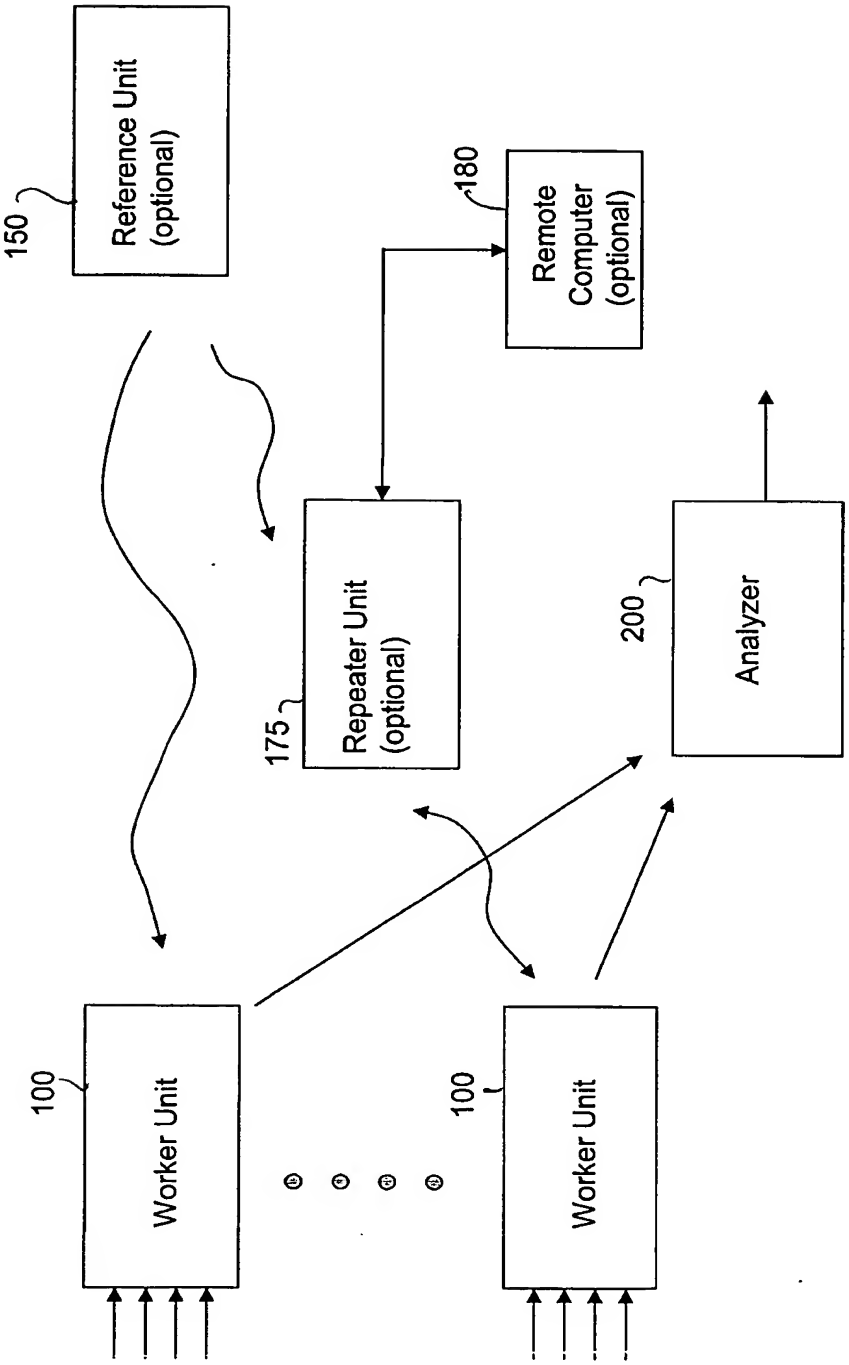

Reference Unit (optional)
150
Remote Computer (optional)
180
Repeater Unit (optional)
175
Analyzer
200
Worker Unit
100
Worker Unit
100

FIG-1

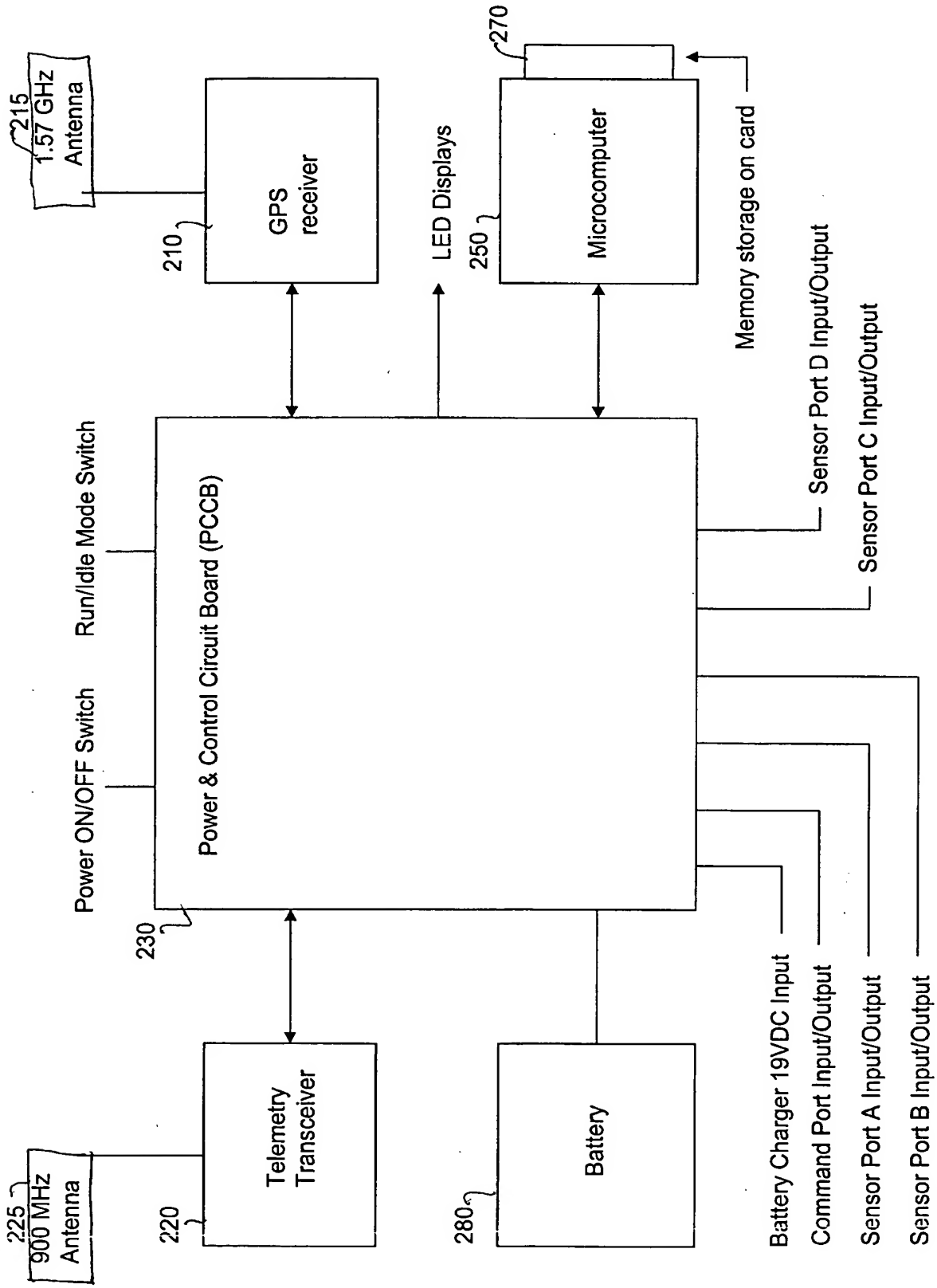

215
1.57 GHz Antenna
210
GPS receiver
LED Displays
270
250
Microcomputer
Memory storage on card
Run/Idle Mode Switch
Power ON/OFF Switch
Power & Control Circuit Board (PCCB)
230
Sensor Port D Input/Output
Sensor Port C Input/Output
225
900 MHz Antenna
220
Telemetry Transceiver
280
Battery
Battery Charger 19VDC Input
Command Port Input/Output
Sensor Port A Input/Output
Sensor Port B Input/Output

FIG. 2A

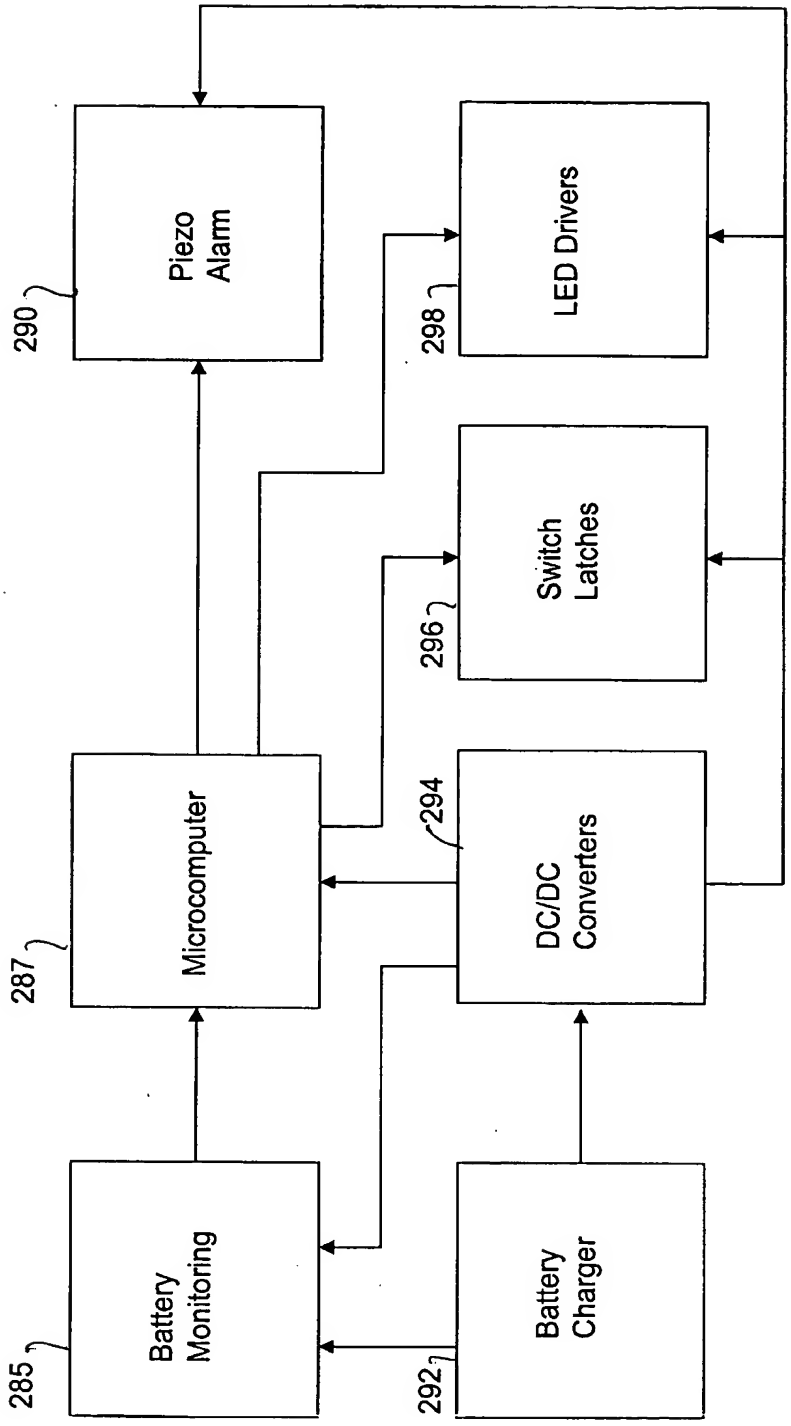

Piezo Alarm
290
LED Drivers
298
Switch Latches
296
Microcomputer
287
294
DC/DC Converters
Battery Monitoring
285
Battery Charger
292

FIG-2B

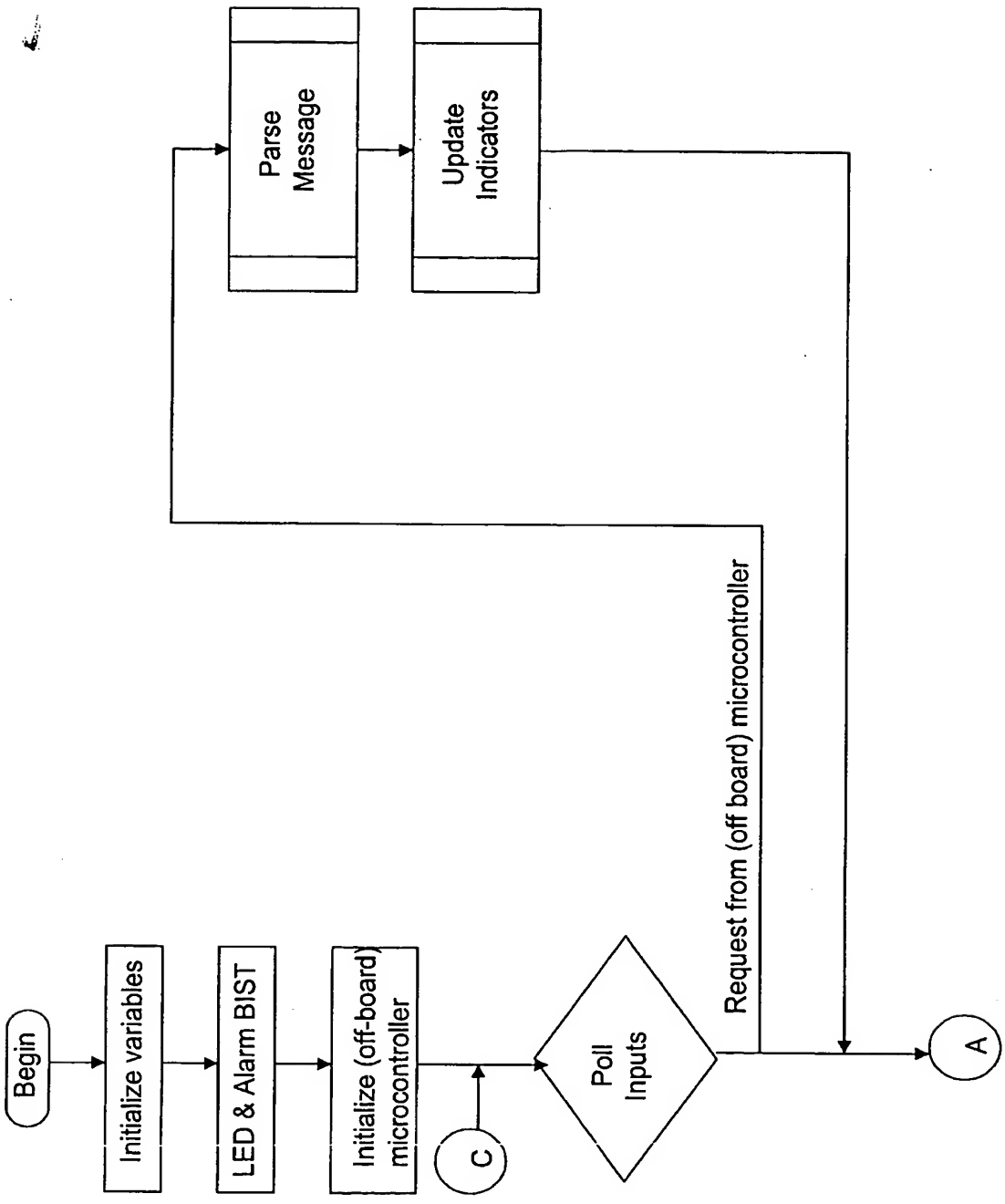

Begin
Initialize variables
LED & Alarm BIST
Initialize (off-board) microcontroller
C
Poll Inputs
Request from (off board) microcontroller
A
Parse Message
Update Indicators

FIG. 3A

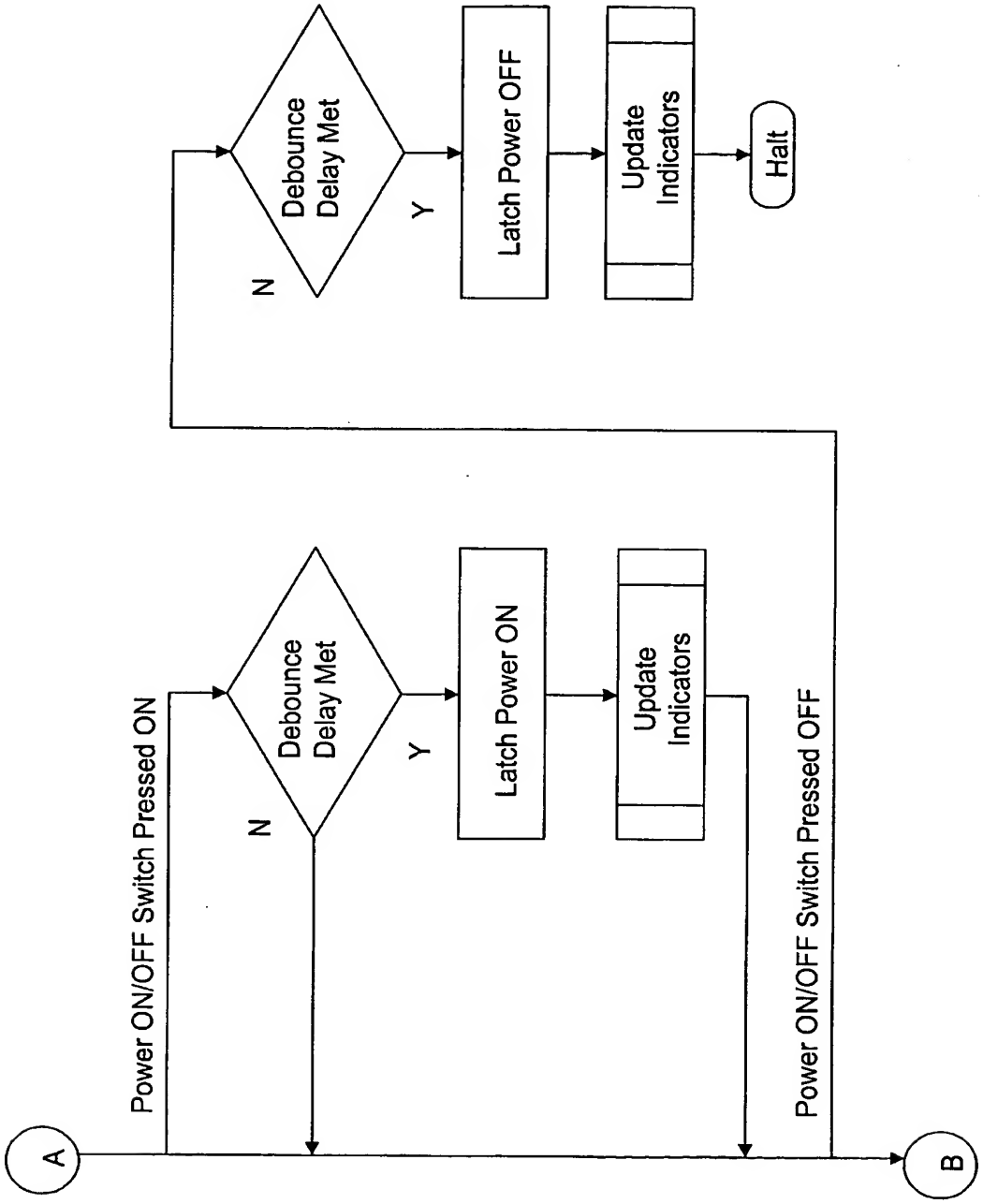

A
Power ON/OFF Switch Pressed ON
Debounce Delay Met
N
Y
Latch Power ON
Update Indicators
Power ON/OFF Switch Pressed OFF
B
Debounce Delay Met
N
Y
Latch Power OFF
Update Indicators
Halt

FIG. 3B

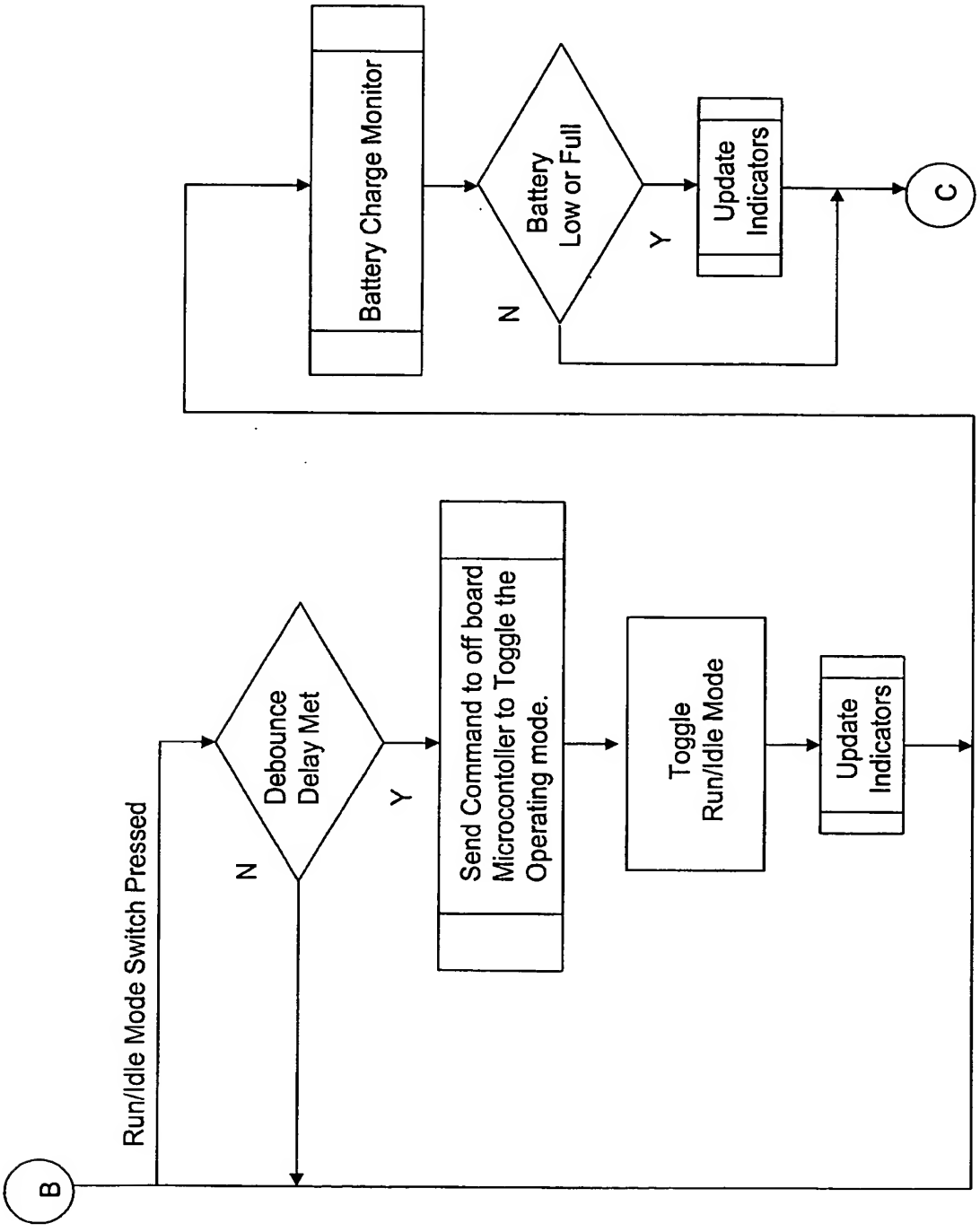

B
Run/Idle Mode Switch Pressed
Debounce Delay Met
N
Y
Send Command to off board Microcontoller to Toggle the Operating mode.
Toggle Run/Idle Mode
Update Indicators
Battery Charge Monitor
Battery Low or Full
N
Y
Update Indicators
C

FIG. 3C

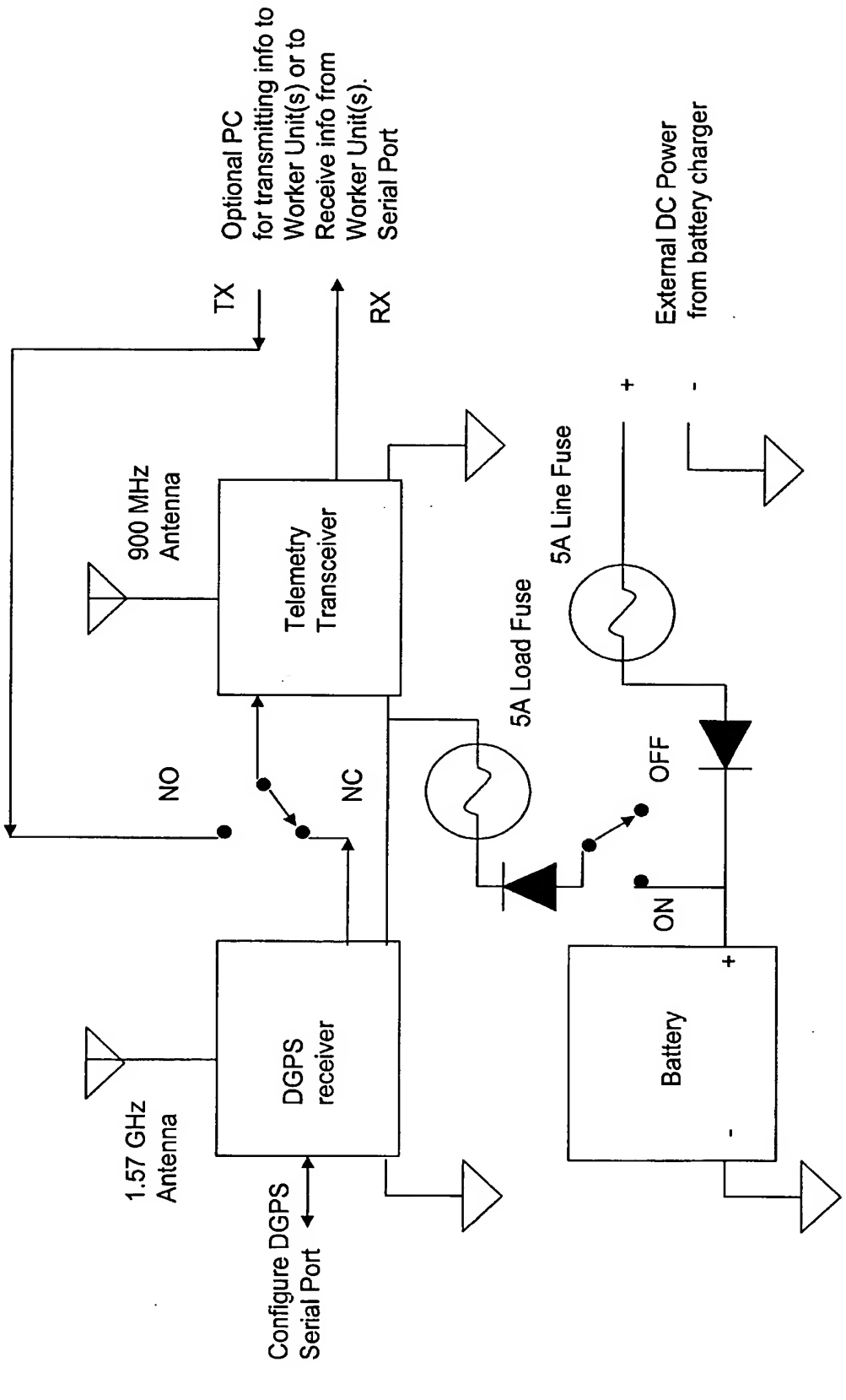

Optional PC for transmitting info to Worker Unit(s) or to Receive info from Worker Unit(s). Serial Port
TX
RX
External DC Power from battery charger
+
-
900 MHz Antenna
Telemetry Transceiver
5A Line Fuse
5A Load Fuse
NO
NC
OFF
ON
1.57 GHz Antenna
DGPS receiver
Battery
+
-
Configure DGPS Serial Port

FIG 4A

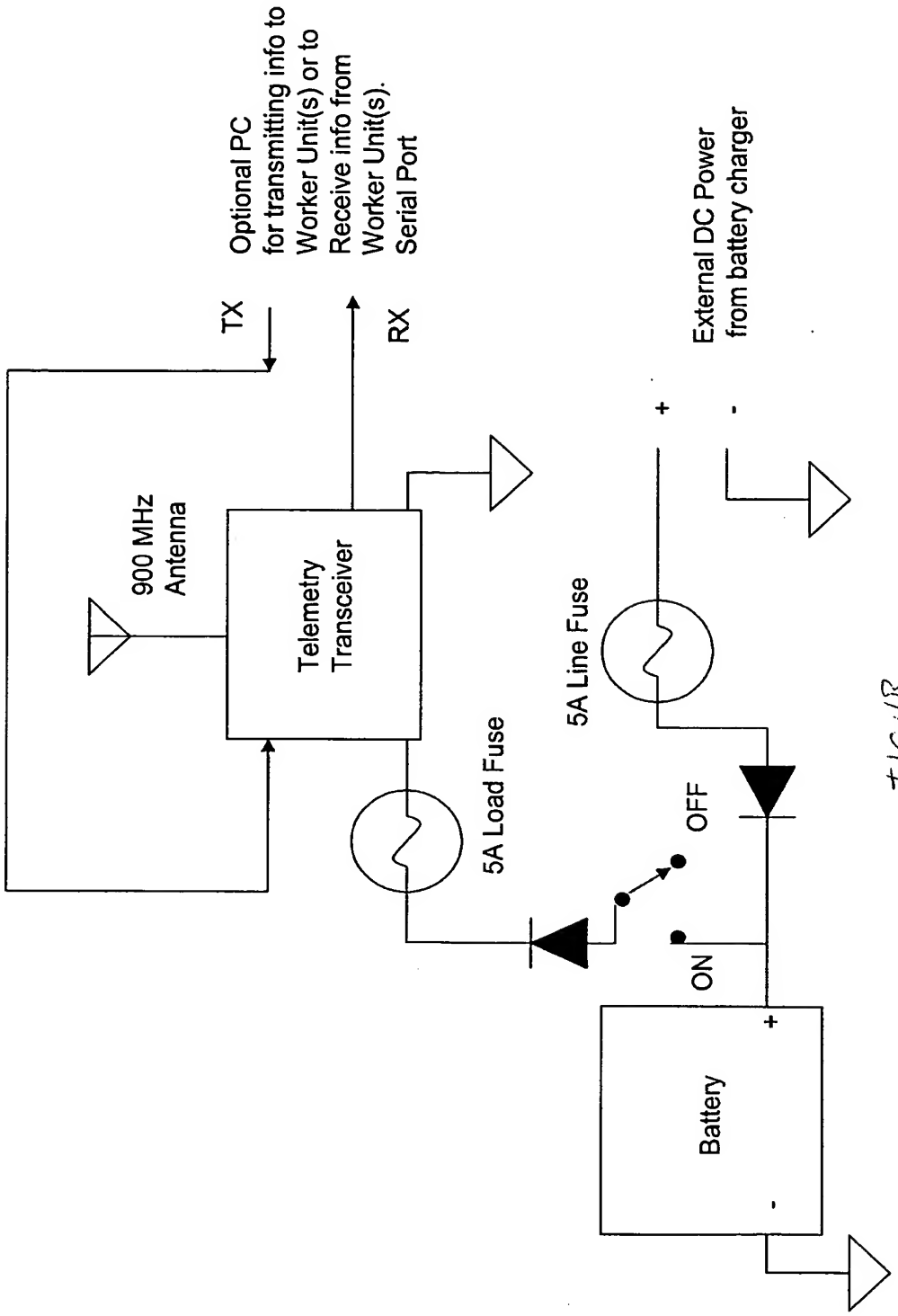

Optional PC
for transmitting info to
Worker Unit(s) or to
Receive info from
Worker Unit(s).
Serial Port
TX
RX
External DC Power
from battery charger
+
-
900 MHz
Antenna
Telemetry
Transceiver
5A Line Fuse
5A Load Fuse
OFF
ON
Battery
+
-

FIG 4B

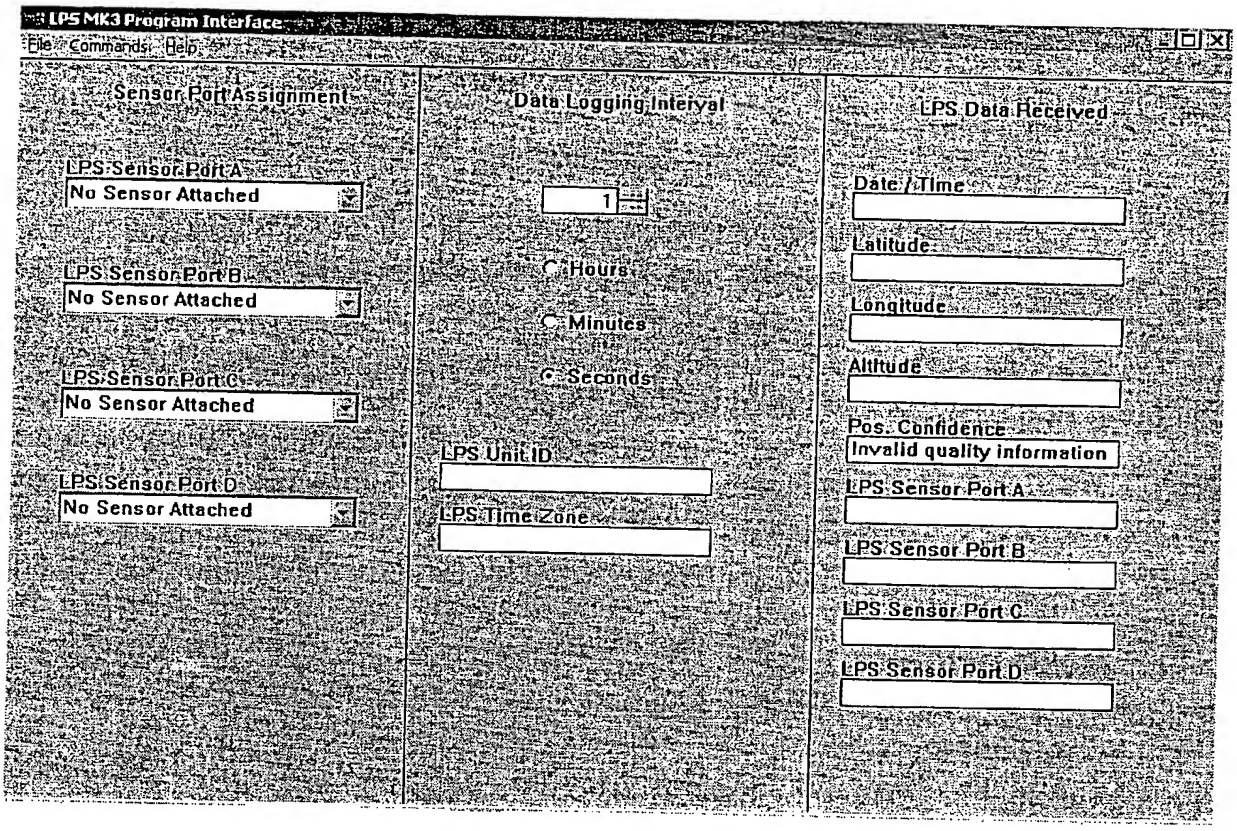

LPS MK3 Program Interface
File Commands Help
Sensor Port Assignment
LPS Sensor Port A
No Sensor Attached
LPS Sensor Port B
No Sensor Attached
LPS Sensor Port C
No Sensor Attached
LPS Sensor Port D
No Sensor Attached
Data Logging Interval
1
Hours
Minutes
Seconds
LPS Unit ID
LPS Time Zone
LPS Data Received
Date / Time
Latitude
Longitude
Altitude
Pos. Confidence
Invalid quality information
LPS Sensor Port A
LPS Sensor Port B
LPS Sensor Port C
LPS Sensor Port D

FIG. 5A

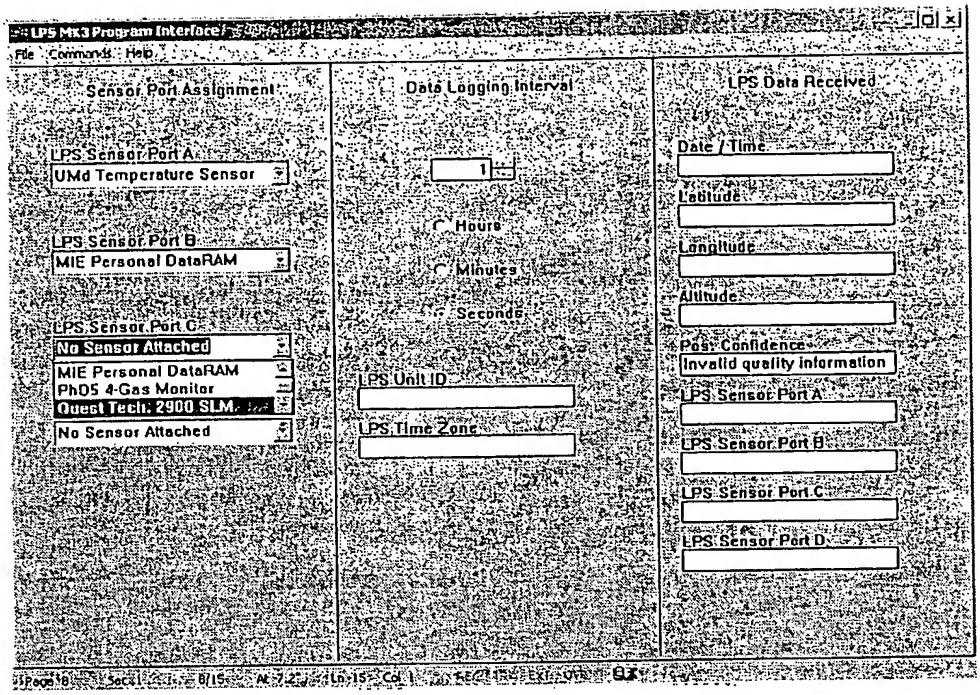

LPS MK3 Program Interface
File Commands Help
Sensor Port Assignment
LPS Sensor Port A
UMd Temperature Sensor
LPS Sensor Port B
MIE Personal DataRAM
LPS Sensor Port C
No Sensor Attached
MIE Personal DataRAM
PhD5 4-Gas Monitor
Quest Tesin 2900 SLM
No Sensor Attached
Data Logging Interval
1
Hours
Minutes
Seconds
LPS Unit ID
LPS Time Zone
LPS Data Received
Date / Time
Latitude
Longitude
Altitude
Pos Confidence
Invalid quality information
LPS Sensor Port A
LPS Sensor Port B
LPS Sensor Port C
LPS Sensor Port D

FIG 5B

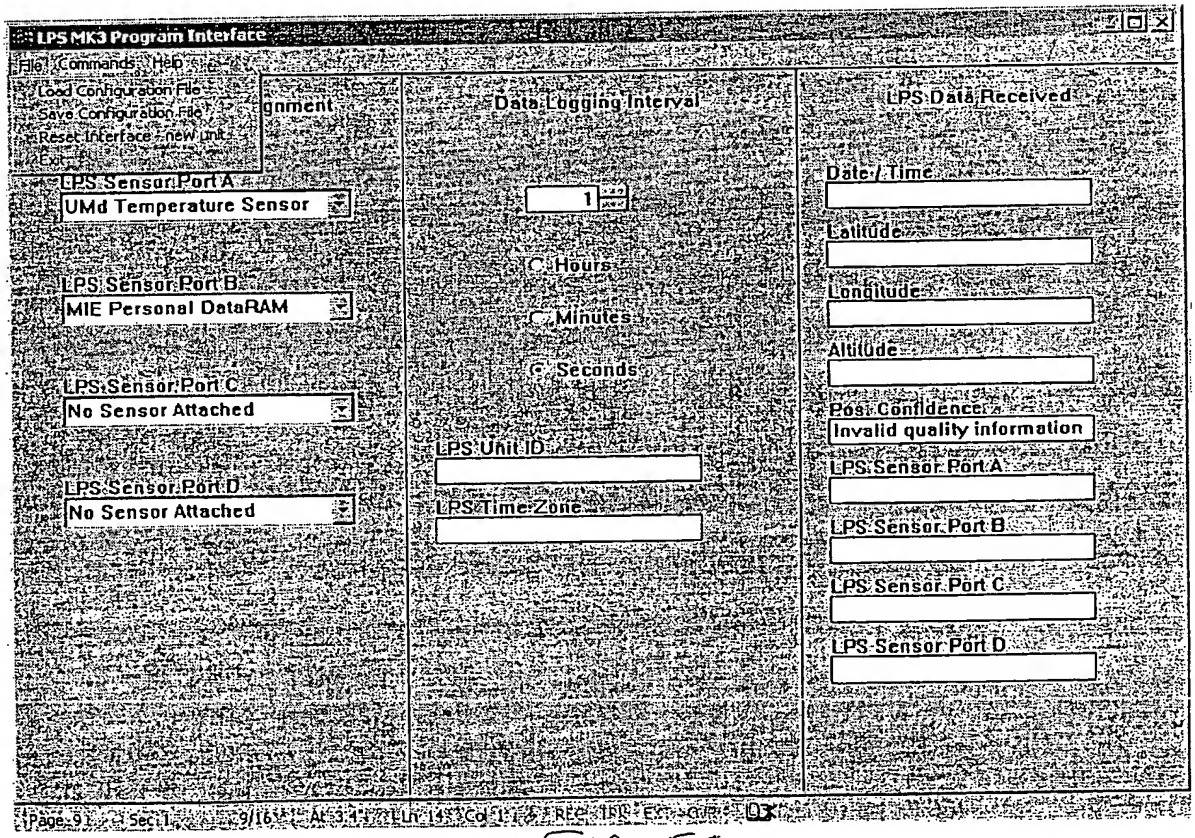

LPS MK3 Program Interface
File Commands Help
Load Configuration File
Save Configuration File
Reset Interface / new Unit
LPS Sensor Port A
UMd Temperature Sensor
LPS Sensor Port B
MIE Personal DataRAM
LPS Sensor Port C
No Sensor Attached
LPS Sensor Port D
No Sensor Attached
Data Logging Interval
1
Hours
Minutes
Seconds
LPS Unit ID
LPS Time Zone
LPS Data Received
Date / Time
Latitude
Longitude
Altitude
Pos Confidence
Invalid quality information
LPS Sensor Port A
LPS Sensor Port B
LPS Sensor Port C
LPS Sensor Port D

FIG 5C

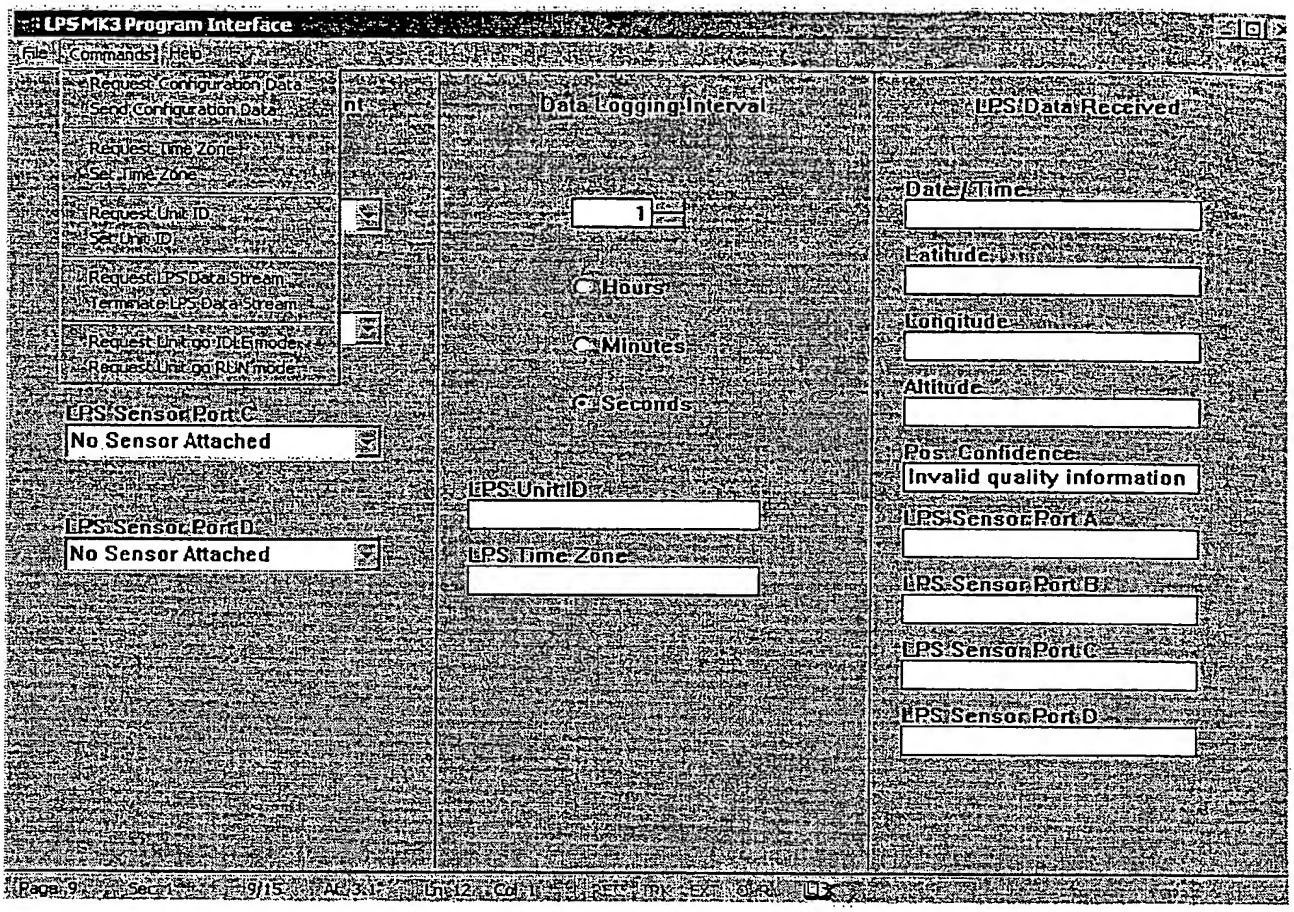

LPS MK3 Program Interface
File
Commands
Help
Request Configuration Data
Send Configuration Data
Request Time Zone
Set Time Zone
Request Unit ID
Set Unit ID
Request LPS Data Stream
Terminate LPS Data Stream
Request Unit go IDLE mode
Request Unit go RUN mode
LPS Sensor Port C
No Sensor Attached
LPS Sensor Port D
No Sensor Attached
Data Logging Interval
1
Hours
Minutes
Seconds
LPS Unit ID
LPS Time Zone
LPS Data Received
Date / Time
Latitude
Longitude
Altitude
Pos. Confidence
Invalid quality information
LPS Sensor Port A
LPS Sensor Port B
LPS Sensor Port C
LPS Sensor Port D

FIG. 5D

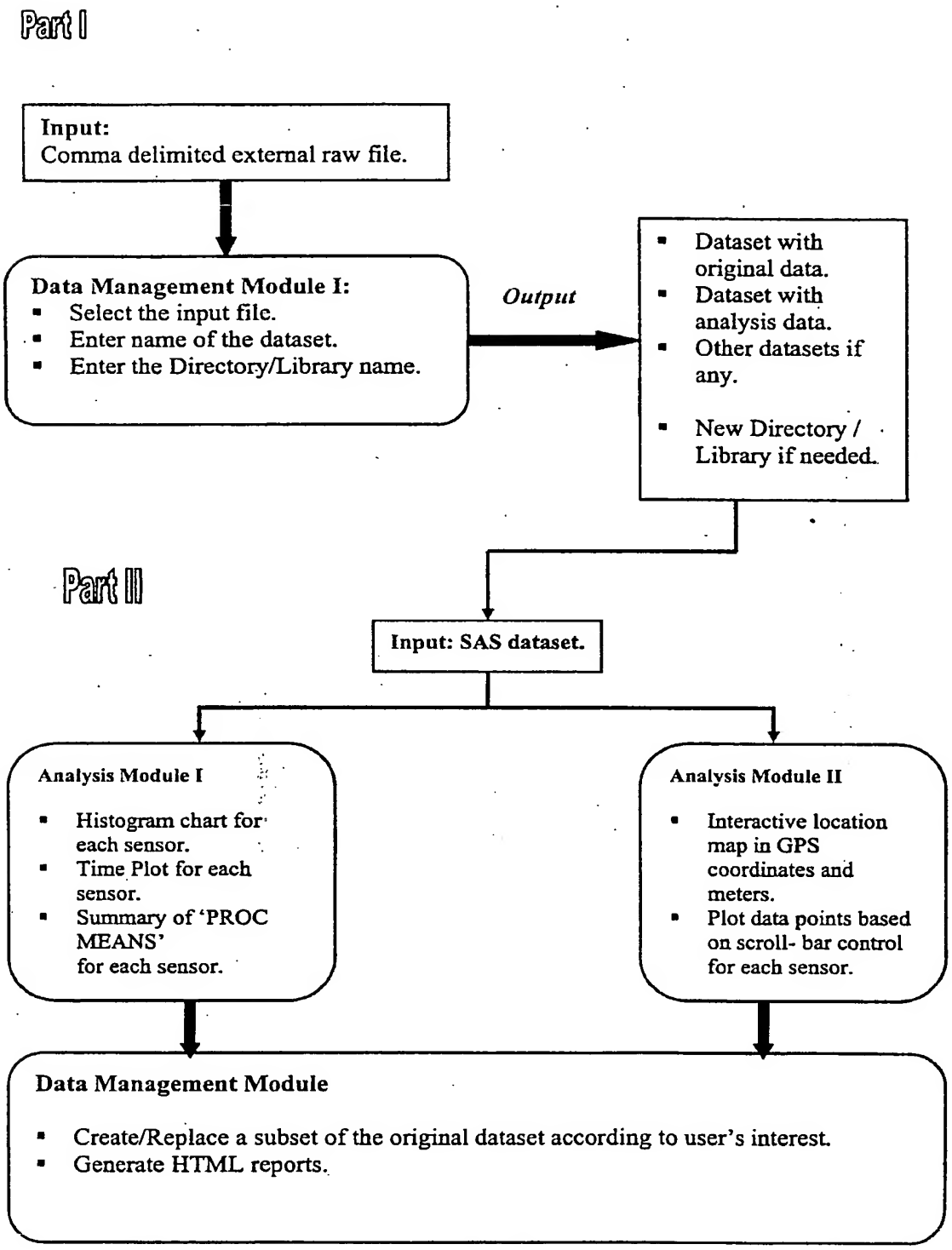

Part I
Input:
Comma delimited external raw file.
Data Management Module I:
Select the input file.
Enter name of the dataset.
Enter the Directory/Library name.
Output
Dataset with original data.
Dataset with analysis data.
Other datasets if any.
New Directory / Library if needed.
Part II
Input: SAS dataset.
Analysis Module I
Histogram chart for each sensor.
Time Plot for each sensor.
Summary of 'PROC MEANS' for each sensor.
Analysis Module II
Interactive location map in GPS coordinates and meters.
Plot data points based on scroll- bar control for each sensor.
Data Management Module
Create/Replace a subset of the original dataset according to user's interest.
Generate HTML reports.

FIG-6

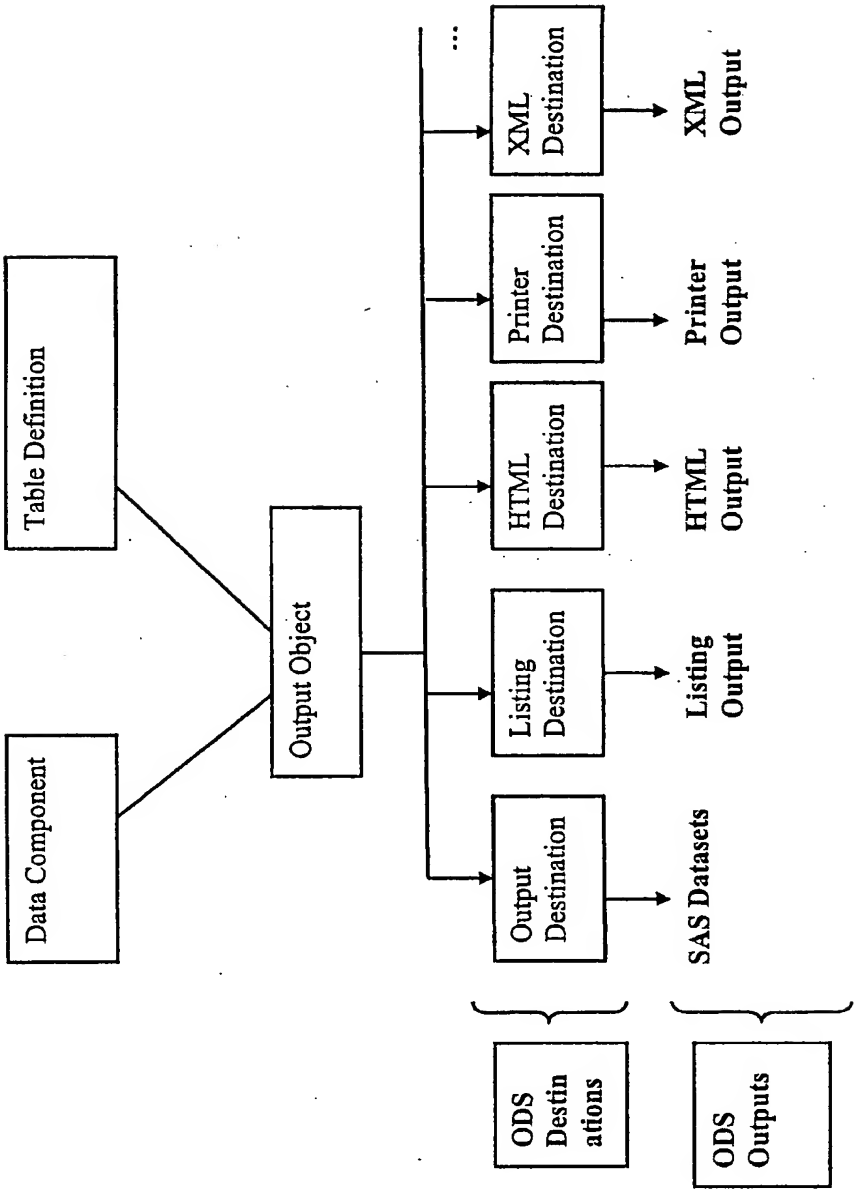


Table Definition
Data Component
Output Object
Output Destination
Listing Destination
HTML Destination
Printer Destination
XML Destination
...
SAS Datasets
Listing Output
HTML Output
Printer Output
XML Output
ODS Destin ations
ODS Outputs

FIG. 7

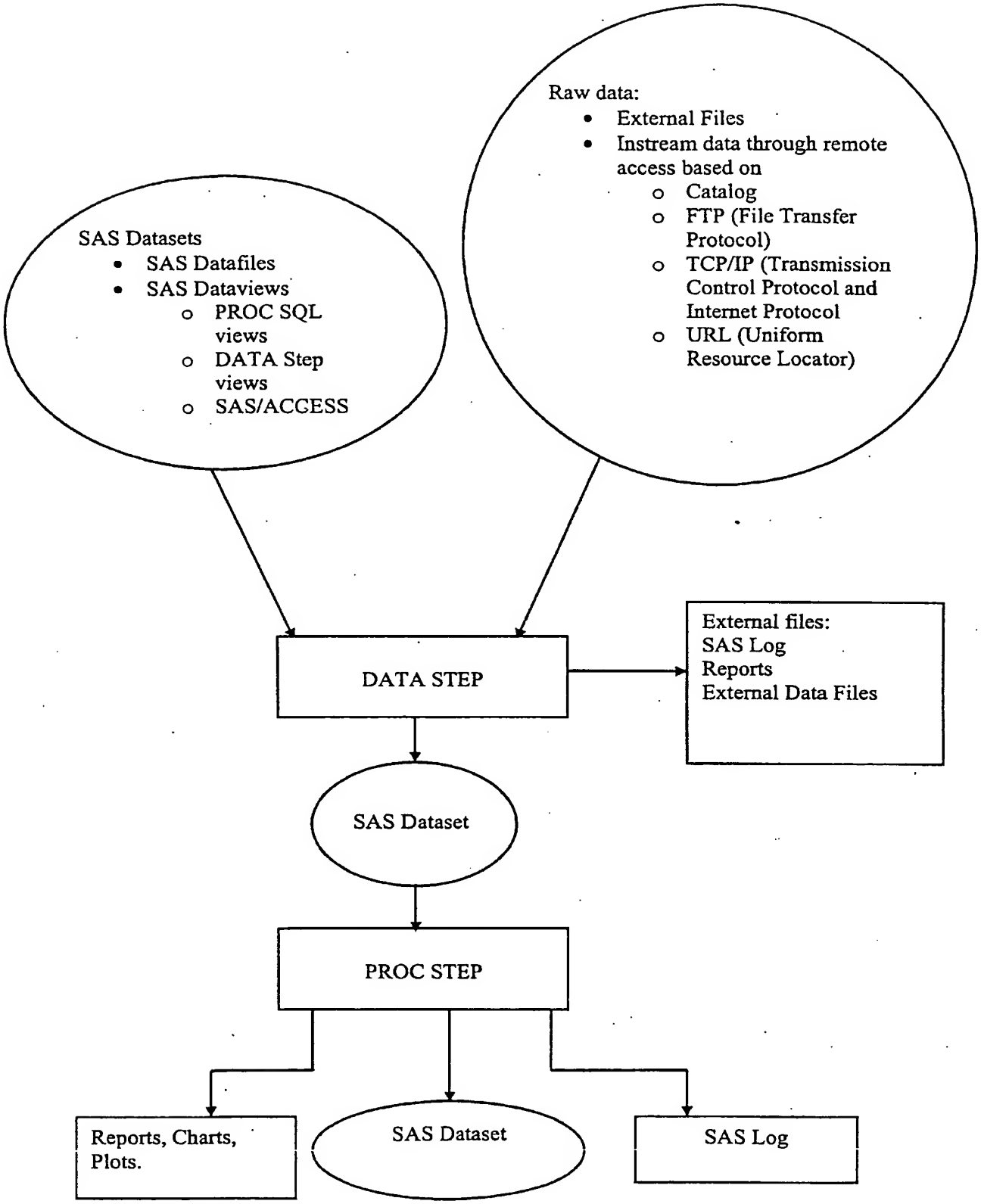

Raw data:
External Files
Instream data through remote access based on
Catalog
FTP (File Transfer Protocol)
TCP/IP (Transmission Control Protocol and Internet Protocol
URL (Uniform Resource Locator)
SAS Datasets
SAS Datafiles
SAS Dataviews
PROC SQL views
DATA Step views
SAS/ACCESS
DATA STEP
External files:
SAS Log
Reports
External Data Files
SAS Dataset
PROC STEP
Reports, Charts, Plots.
SAS Dataset
SAS Log

FIG. 8

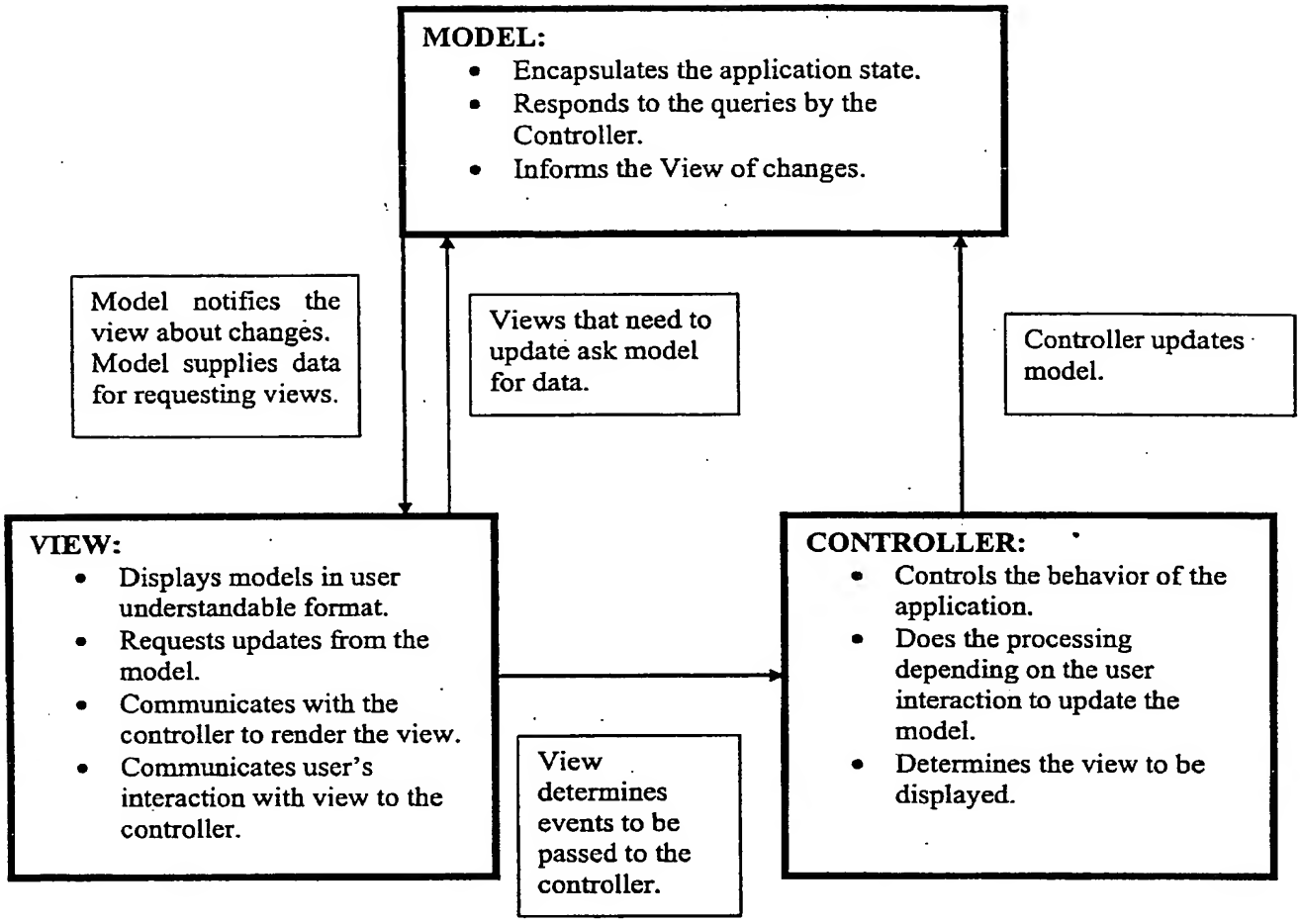

MODEL:
Encapsulates the application state.
Responds to the queries by the Controller.
Informs the View of changes.
Model notifies the view about changes. Model supplies data for requesting views.
Views that need to update ask model for data.
Controller updates model.
VIEW:
Displays models in user understandable format.
Requests updates from the model.
Communicates with the controller to render the view.
Communicates user's interaction with view to the controller.
View determines events to be passed to the controller.
CONTROLLER:
Controls the behavior of the application.
Does the processing depending on the user interaction to update the model.
Determines the view to be displayed.

FIG 9

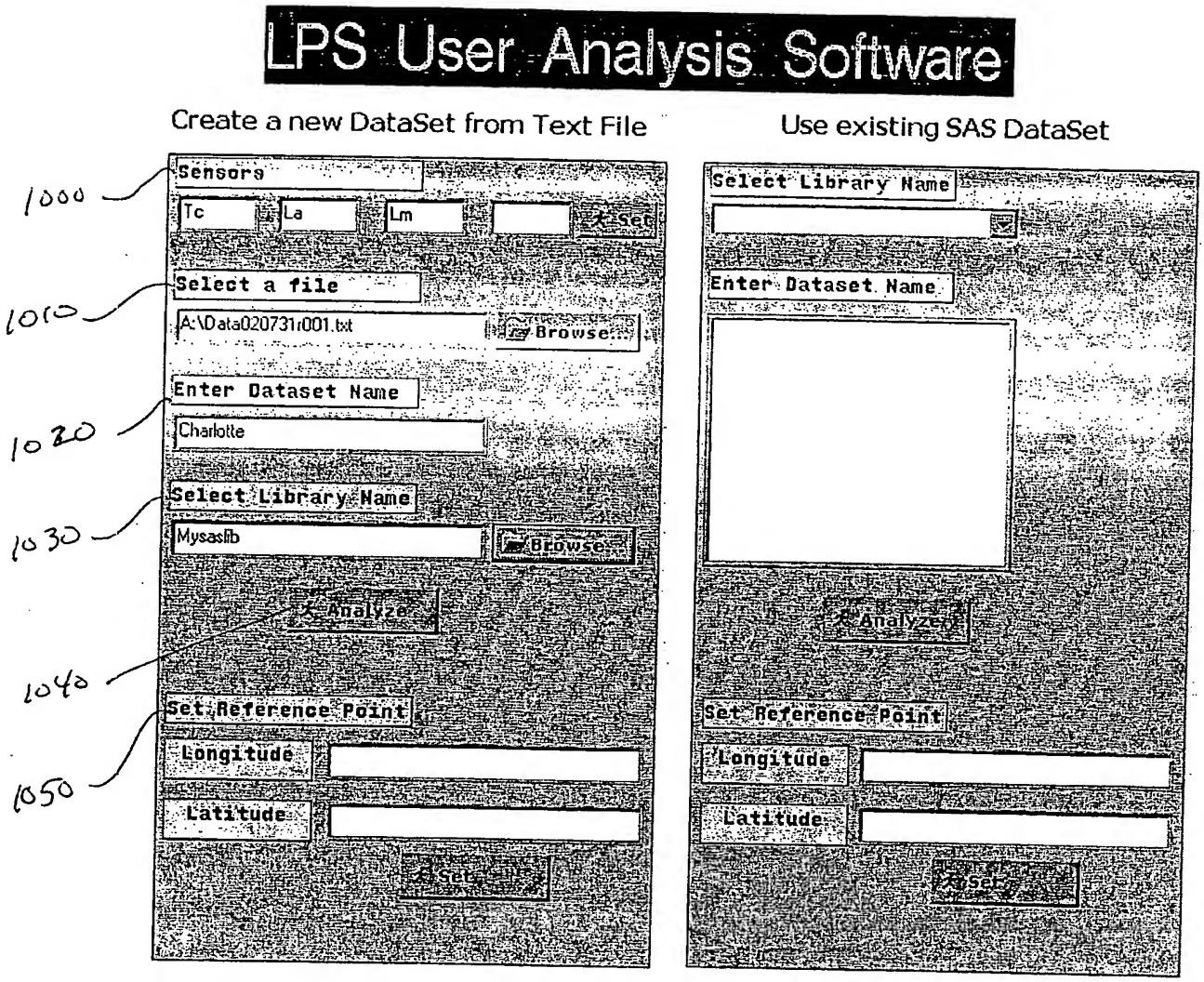

LPS User Analysis Software
Create a new DataSet from Text File
Use existing SAS DataSet
1000
1010
1020
1030
1040
1050
Sensors
Tc
La
Lm
Set
Select a file
A:\Data020731r001.txt
Browse...
Enter Dataset Name
Charlotte
Select Library Name
Mysaslib
Browse...
Analyze
Set Reference Point
Longitude
Latitude
Set
Select Library Name
Enter Dataset Name
Analyze
Set Reference Point
Longitude
Latitude
Set

FIG. 10

Obs	STAT	DUST	LAVG	LMAX
1	N	2032.00	2032.00	2032.00
2	MIN	718.00	51.60	51.60
3	MAX	952.00	91.20	93.40
4	MEAN	763.48	64.55	66.07
5	STD	16.75	8.17	8.61
6	N (>0)	2032.00	.	.
7	GMN	763.31	.	.
8	GSD	1.02	.	.

FIG-11A

Variable: DUST

Quantiles (Definition 5)	
Quantile	Estimate
100% Max	952
99%	826
95%	790
90%	780
75% Q3	768
50% Median	759
25% Q1	754
10%	751
5%	749
1%	741
0% Min	718

FIG-11C

Variable: LAVG

Quantiles (Definition 5)	
Quantile	Estimate
100% Max	91.2
99%	82.0
95%	78.0
90%	75.7
75% Q3	70.9
50% Median	64.5
25% Q1	57.5
10%	53.6
5%	52.3
1%	51.6
0% Min	51.6

FIG-11D

Variable: LMAX

Quantiles (Definition 5)	
Quantile	Estimate
100% Max	93.40
99%	83.90
95%	79.70
90%	77.60
75% Q3	73.00
50% Median	66.10
25% Q1	58.85
10%	54.30
5%	52.90
1%	51.60
0% Min	51.60

FIG-11E

Obs	position_conf	STAT	datetime	lat_meters	lon_meters	alt_meters	DUST	LAVG	LMAX
1		N	01JAN60:00:33:52.0	2032.00	2032.00	2032	2032	2032.0	2032.0
2		MIN	23MAY02:10:24:22.0	-635.54	-26.38	325	718	51.6	51.6
3		MAX	23MAY02:10:58:41.0	53.52	142.32	511	952	91.2	93.4
4		MEAN	23MAY02:10:41:29.9	-380.63	69.36	356	763	64.5	66.1
5		STD	01JAN60:00:09:55.7	208.23	52.73	29	17	8.2	8.6
6	2DD	N	01JAN60:00:04:16.0	256.00	256.00	256	256	256.0	256.0
7	2DD	MIN	23MAY02:10:24:32.0	-635.48	-2.58	330	747	51.6	51.6
8	2DD	MAX	23MAY02:10:58:05.0	52.29	142.32	389	812	81.2	83.2
9	2DD	MEAN	23MAY02:10:44:14.5	-469.84	79.39	362	762	65.3	66.7
10	2DD	STD	01JAN60:00:06:37.8	145.32	49.49	15	10	8.0	8.4
11	2DU	N	01JAN60:00:00:17.0	17.00	17.00	17	17	17.0	17.0
12	2DU	MIN	23MAY02:10:33:37.0	-551.90	-11.77	344	746	51.7	52.0
13	2DU	MAX	23MAY02:10:51:13.0	-401.20	115.67	411	871	71.5	73.3
14	2DU	MEAN	23MAY02:10:46:32.1	-476.12	44.39	360	770	57.3	58.2
15	2DU	STD	01JAN60:00:05:35.7	68.27	53.07	16	31	6.1	6.6
16	3DD	N	01JAN60:00:23:03.0	1383.00	1383.00	1383	1383	1383.0	1383.0
17	3DD	MIN	23MAY02:10:24:22.0	-635.54	-8.23	325	718	51.6	51.6
18	3DD	MAX	23MAY02:10:58:41.0	53.52	142.19	405	952	91.2	93.4
19	3DD	MEAN	23MAY02:10:39:19.2	-321.99	78.58	348	764	65.1	66.6
20	3DD	STD	01JAN60:00:10:45.6	216.45	51.17	16	18	8.2	8.6
21	3DU	N	01JAN60:00:06:03.0	363.00	363.00	363	363	363.0	363.0
22	3DU	MIN	23MAY02:10:29:47.0	-627.36	-26.38	332	734	51.6	51.6
23	3DU	MAX	23MAY02:10:51:26.0	-272.03	116.57	511	829	79.0	80.3
24	3DU	MEAN	23MAY02:10:47:55.2	-533.97	26.78	386	761	62.4	63.9
25	3DU	STD	01JAN60:00:03:12.8	79.69	37.98	49	12	7.9	8.5
26	CDR	N	01JAN60:00:00:13.0	13.00	13.00	13	13	13.0	13.0
27	CDR	MIN	23MAY02:10:33:17.0	-459.51	111.39	344	755	61.3	62.4
28	CDR	MAX	23MAY02:10:33:36.0	-449.85	112.66	344	786	68.4	70.1
29	CDR	MEAN	23MAY02:10:33:27.3	-455.80	112.18	344	769	64.5	66.1
30	CDR	STD	01JAN60:00:00:07.1	4.89	0.64	0	11	1.6	1.9

FIG-11B

FIG. 11F

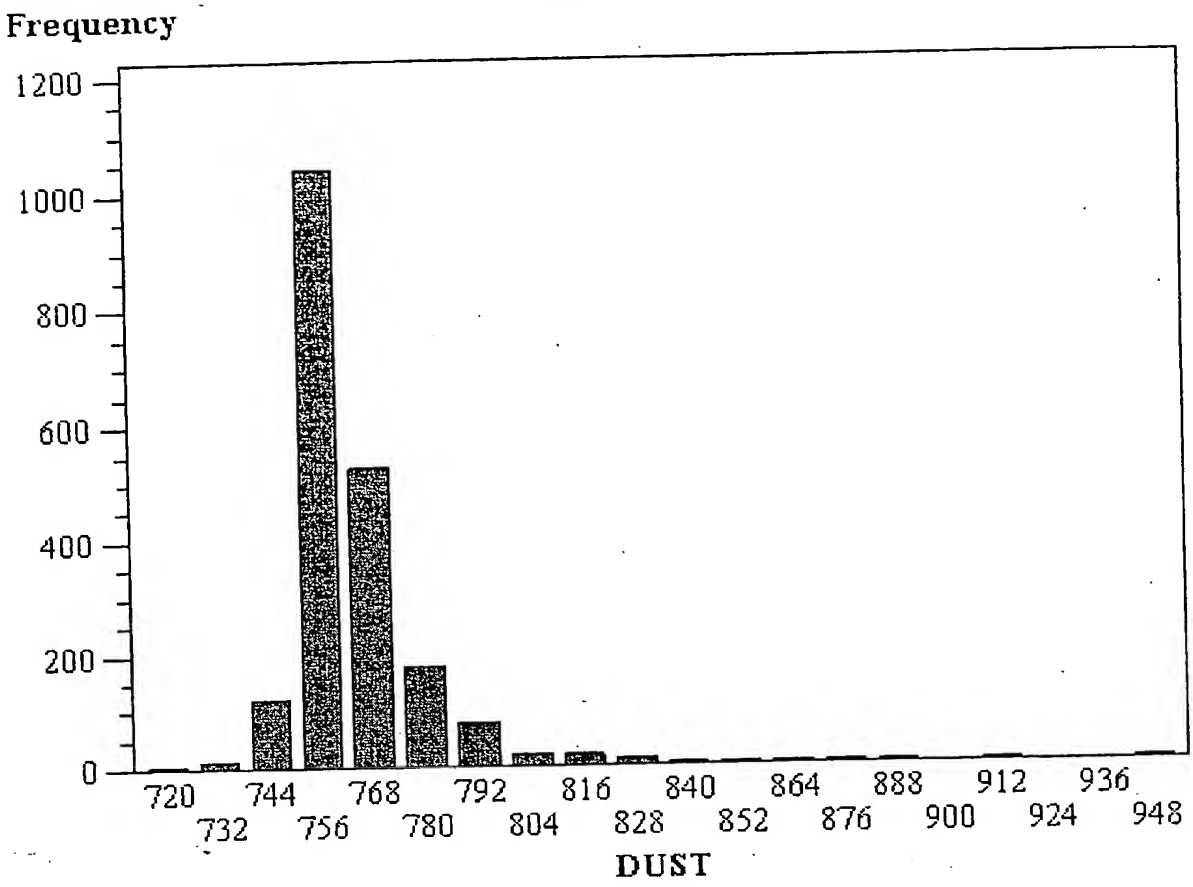


FIG. 11G

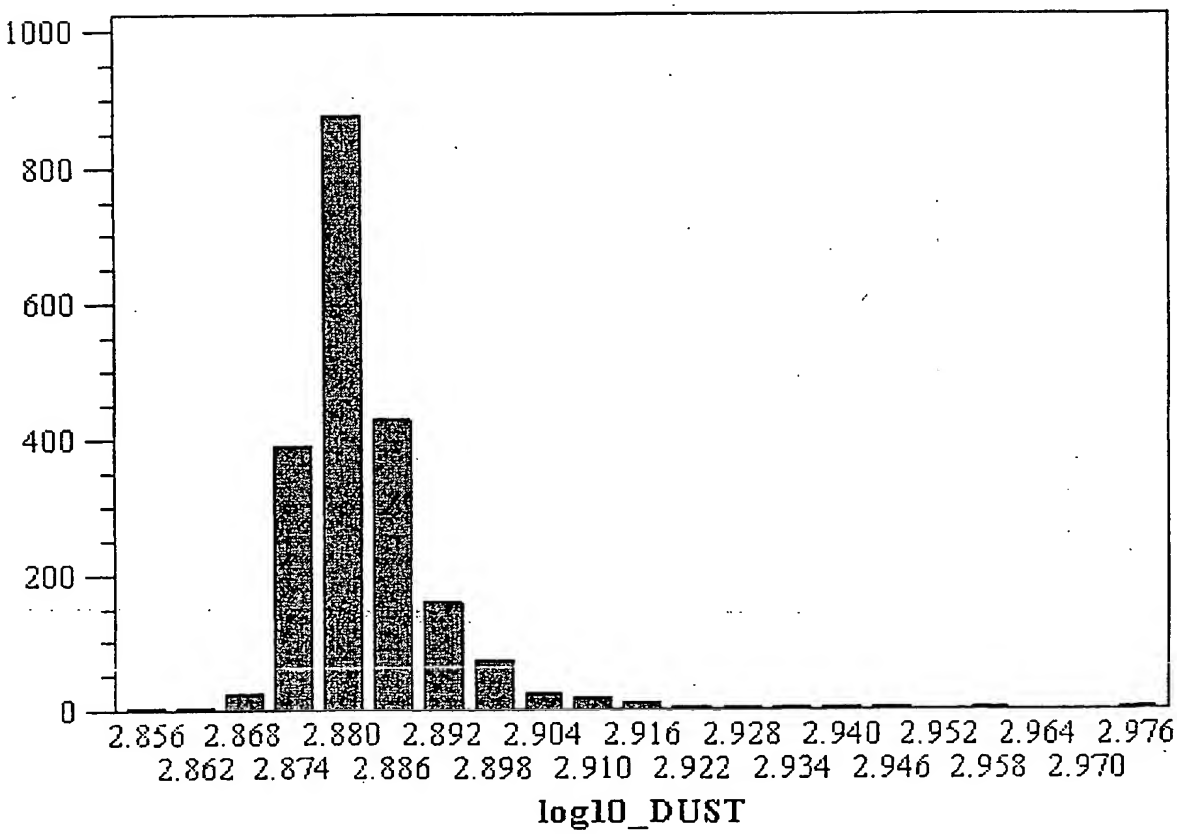


FIG. 11H

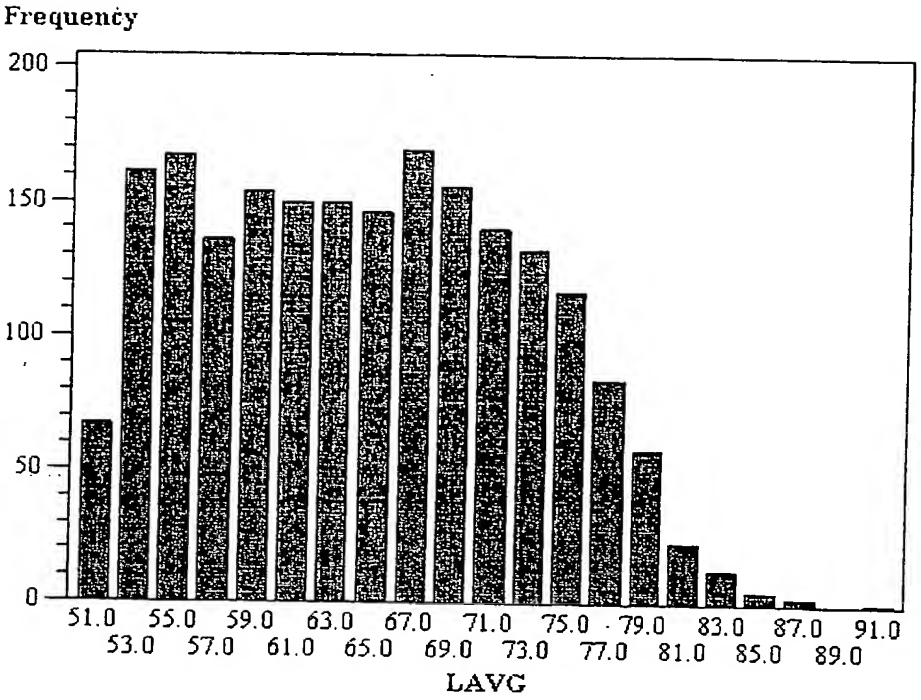
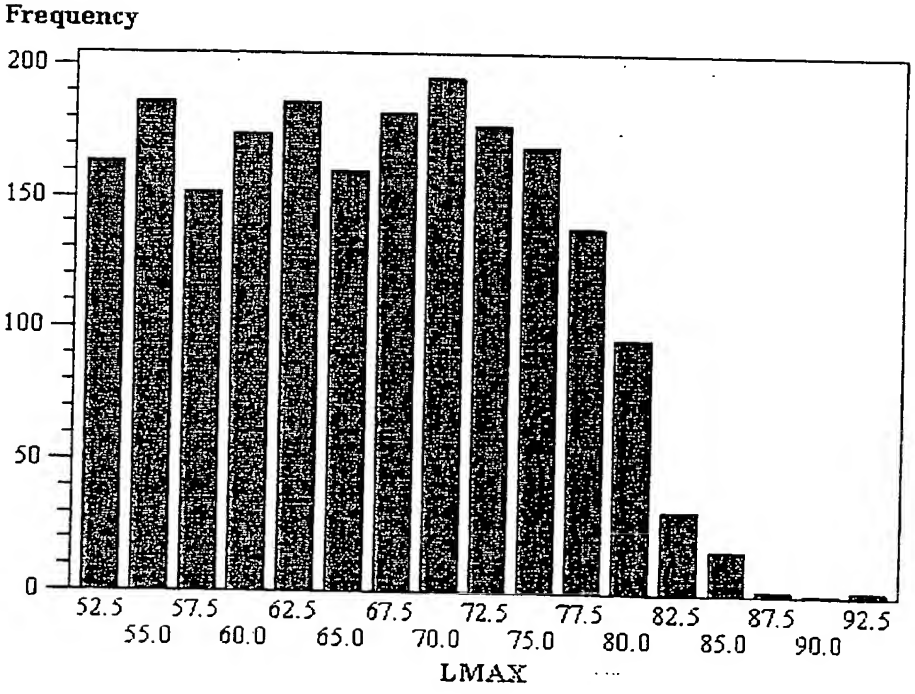


FIG. 11I



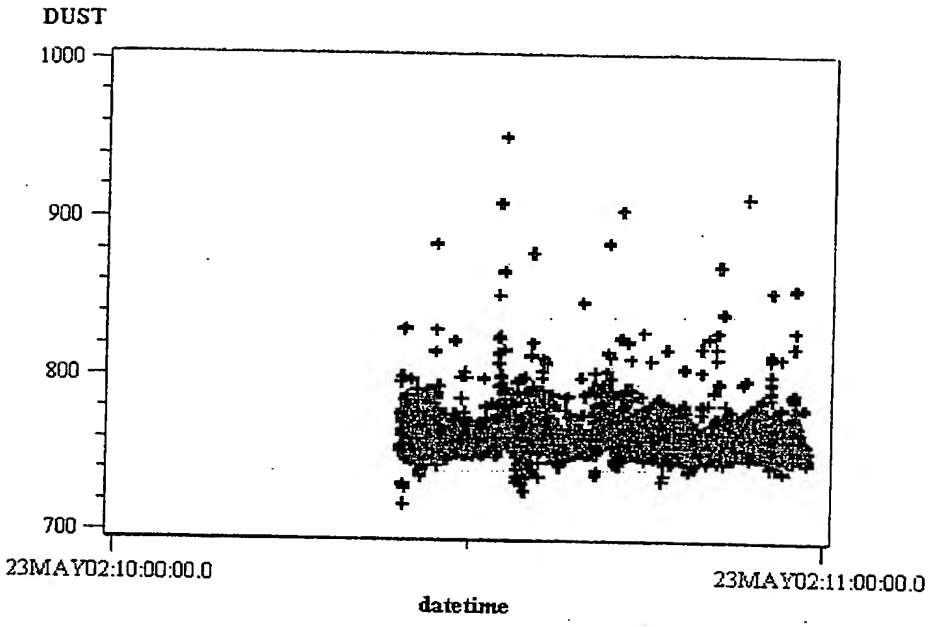


FIG. 11J

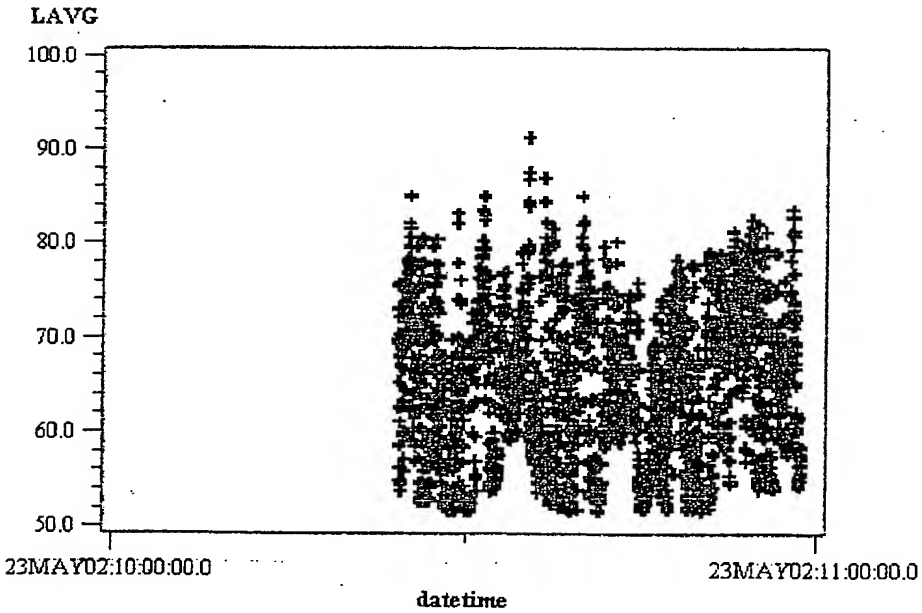


FIG. 11K

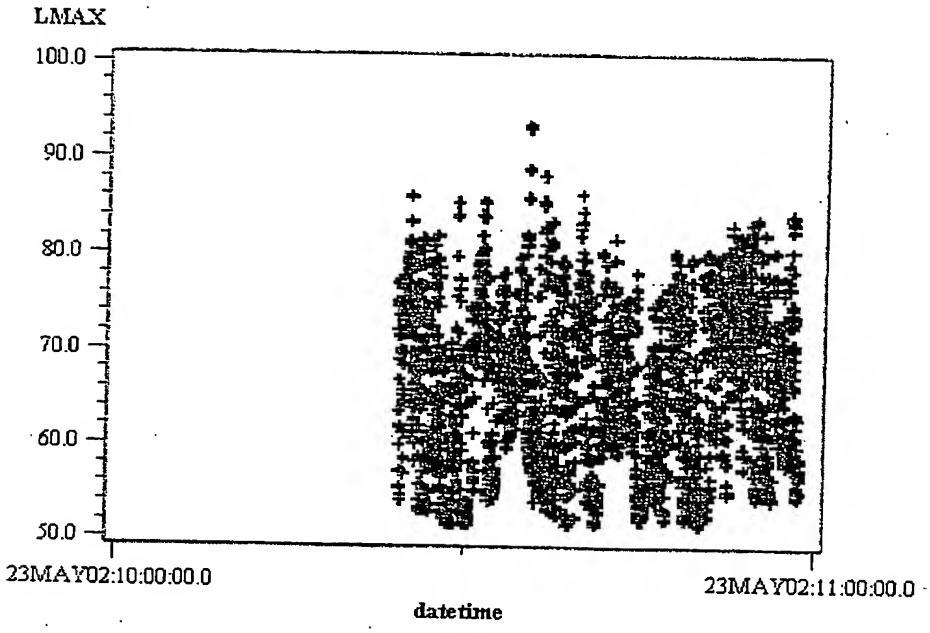


FIG. 11L

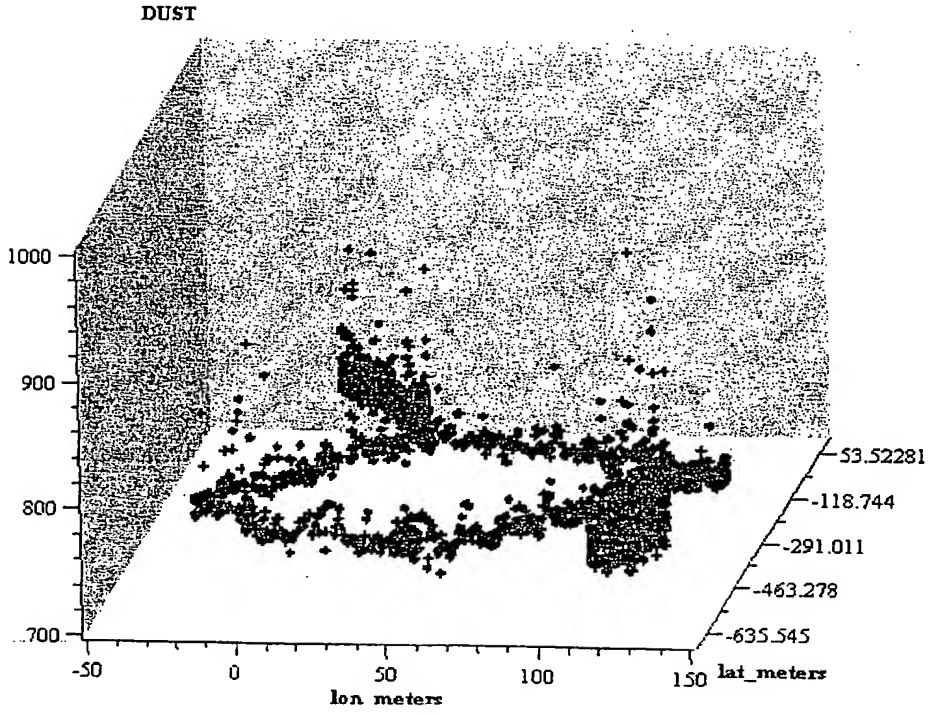


FIG. 11M

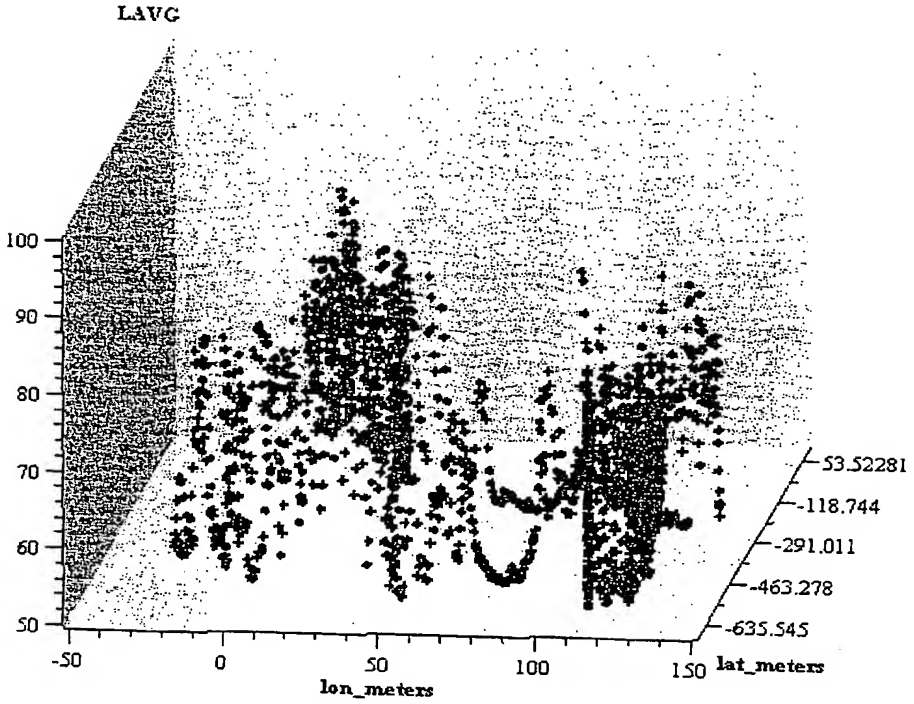


FIG. 11N

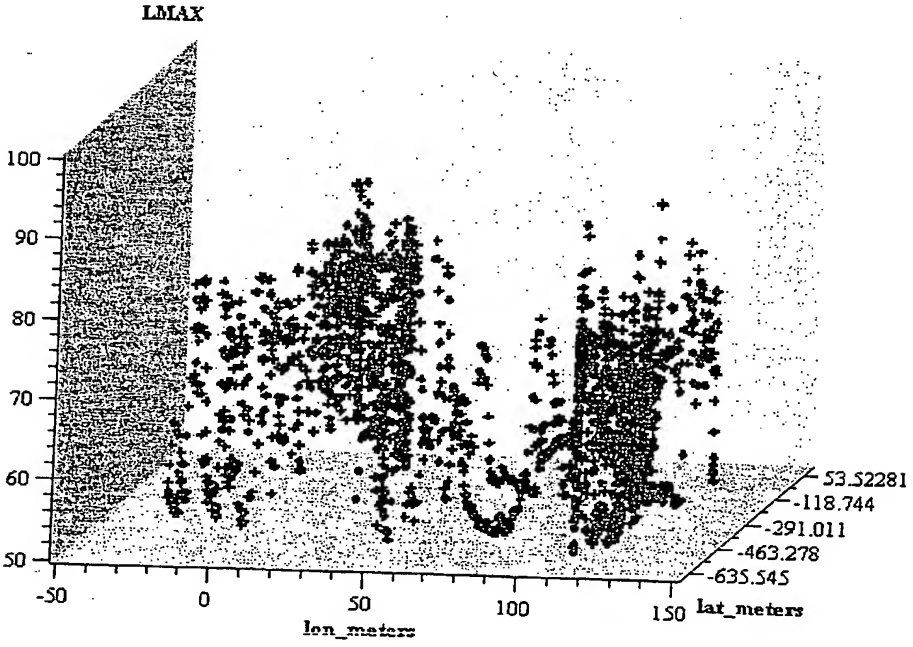


FIG. 11O

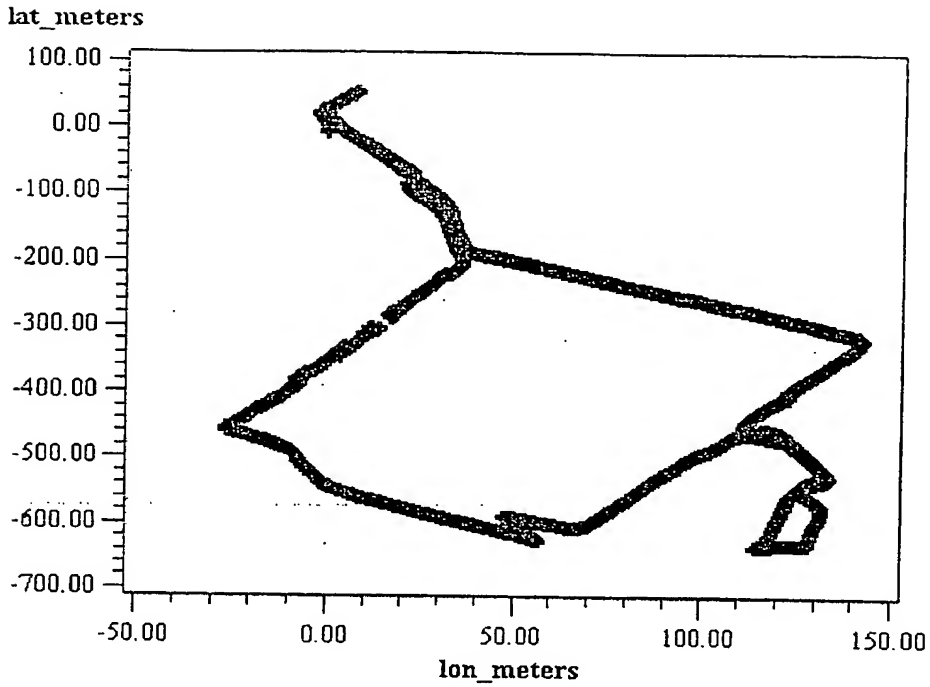


FIG 11P

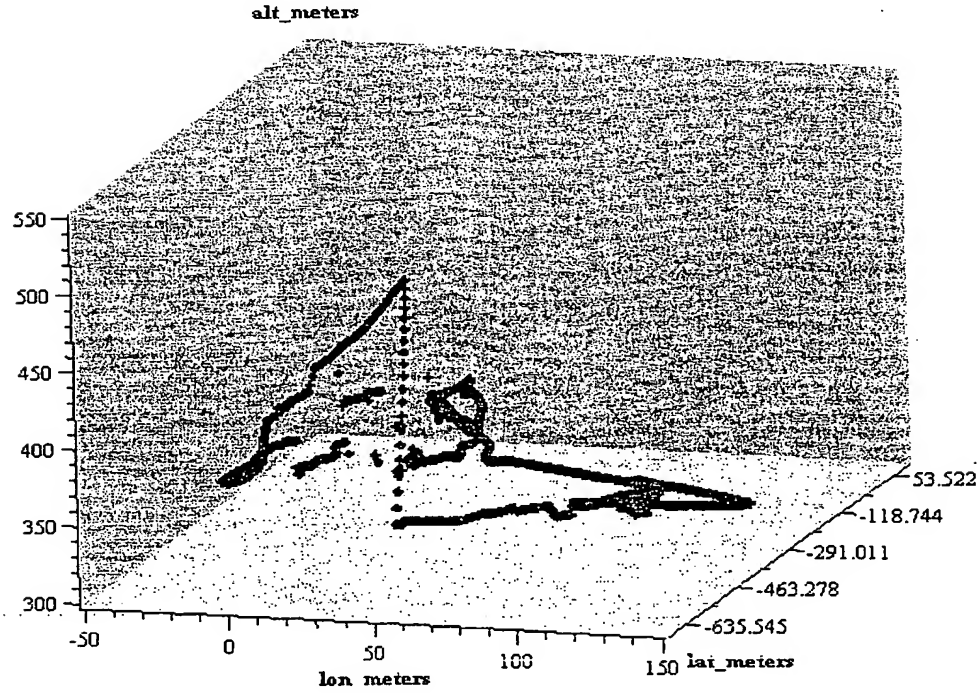


FIG 11Q

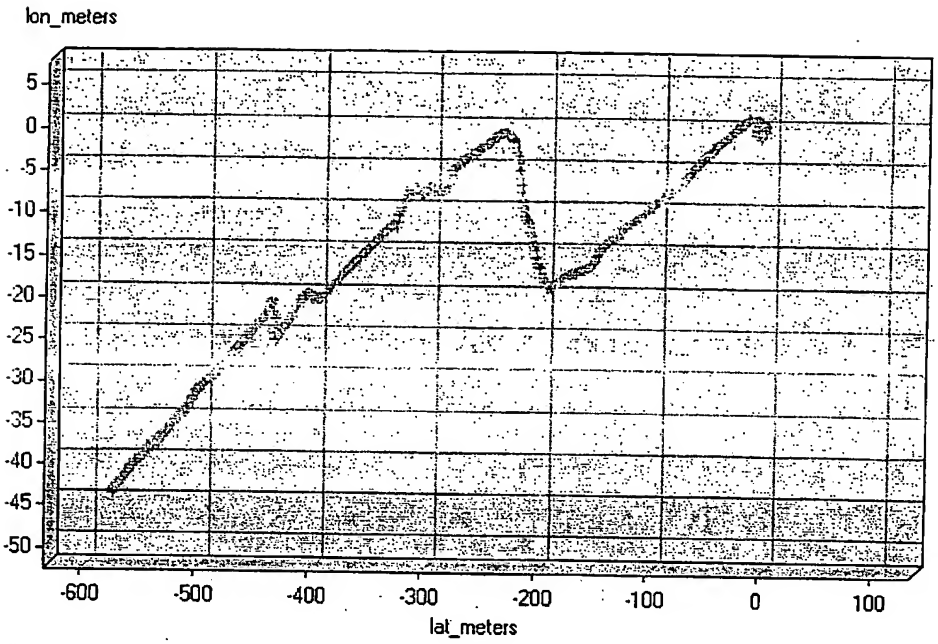


FIG. 11R

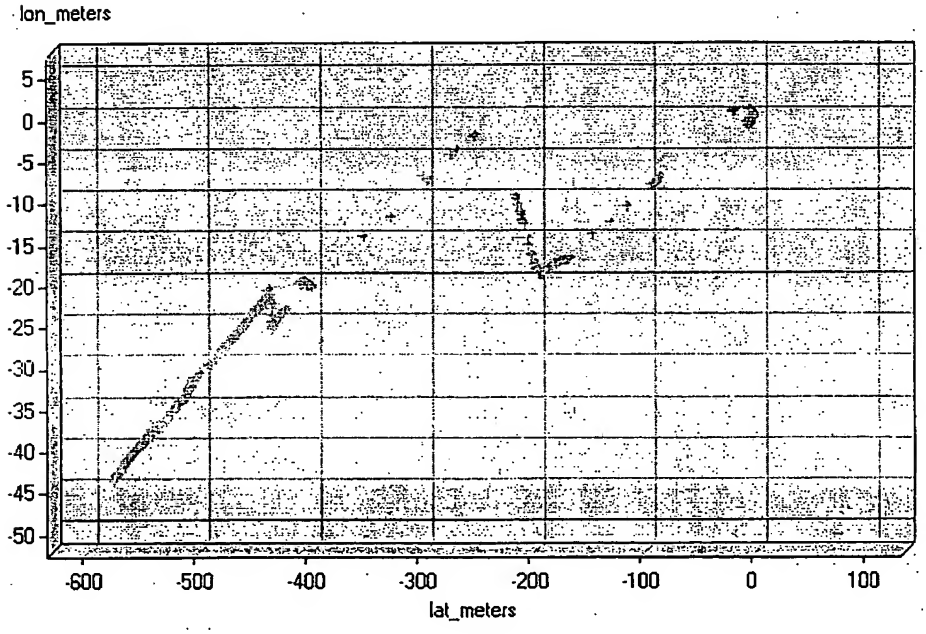


FIG. 11S

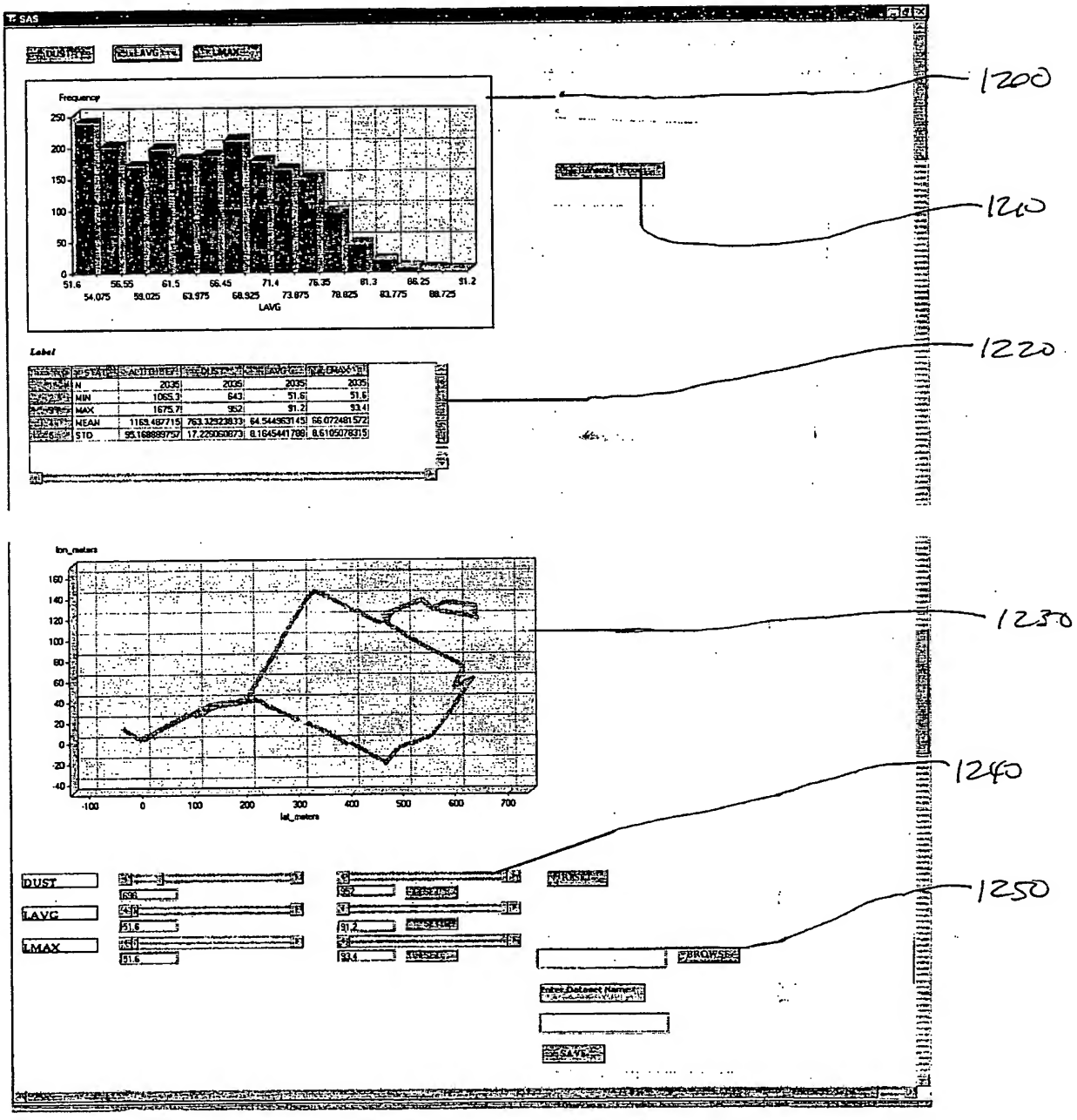

1200
1210
1220
1230
1240
1250
Frequency
LAVG
Label
DUST
LAVG
LMAX
BROWSE
SAVE

FIG 12

FIG-13

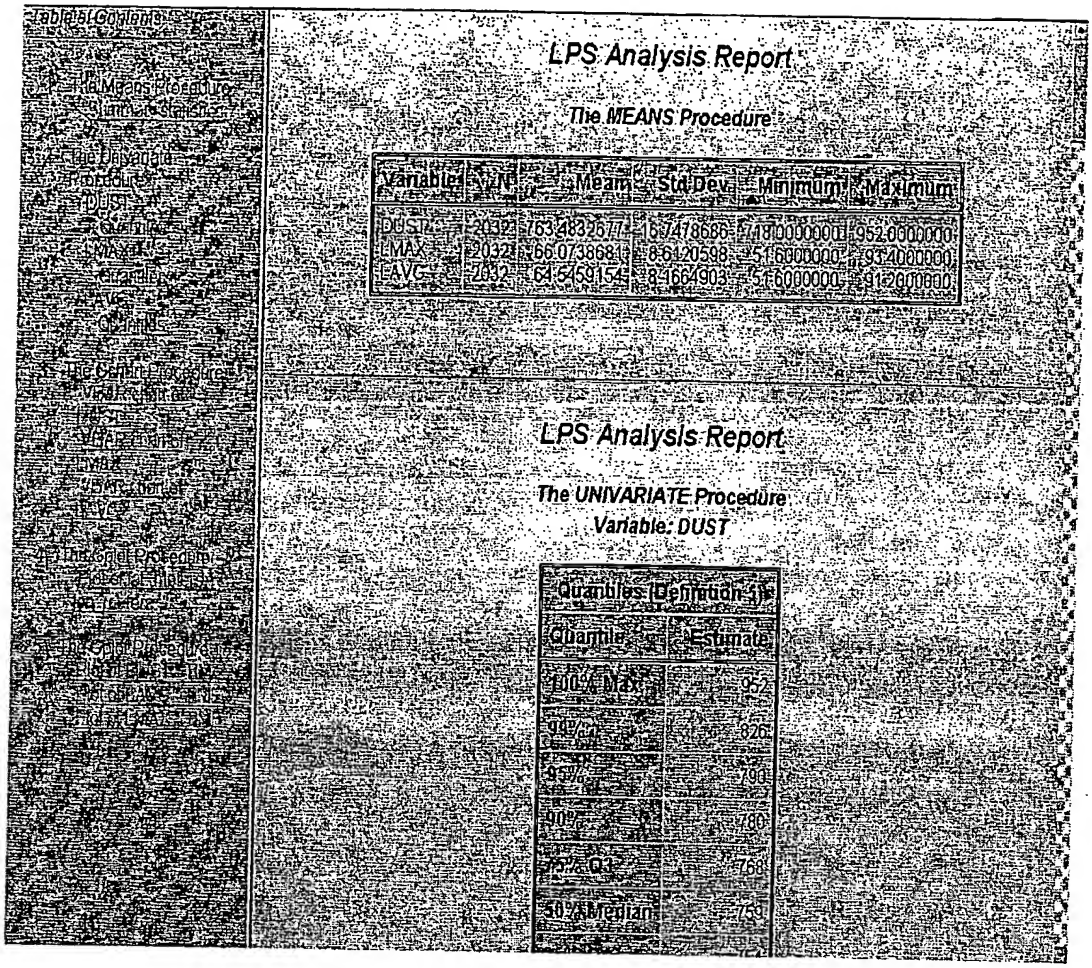
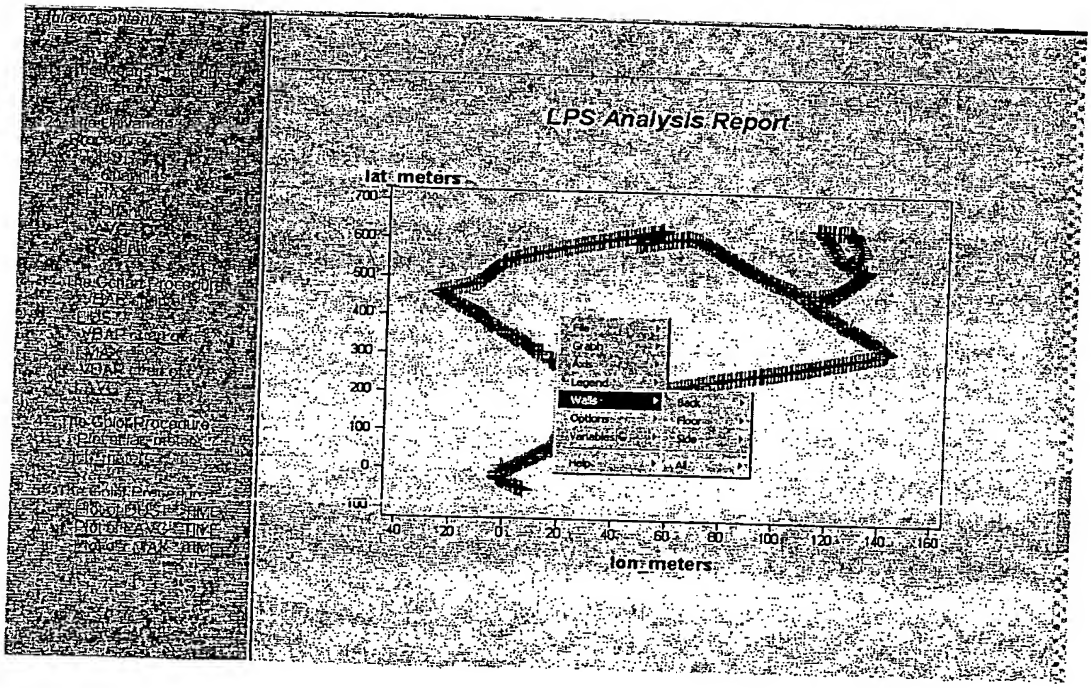

LPS Analysis Report
The MEANS Procedure
Variable N Mean Std Dev Minimum Maximum
DUST 2032 763.4832677 16.7478686 711.0000000 962.0000000
MAX 2032 66.0738681 8.6120598 51.6000000 91.4000000
AVG 2032 64.5459154 8.4164903 51.6000000 91.2000000
LPS Analysis Report
The UNIVARIATE Procedure
Variable: DUST
Quantiles (Definition 5)
Quantile Estimate
100% Max 952
99% 826
95% 799
90% 780
75% Q3 768
50% Median 759

FIG-14


LPS Analysis Report
lat meters
lon meters
700
600
500
400
300
200
100
0
-100
-40
-20
0
20
40
60
80
100
120
140
160

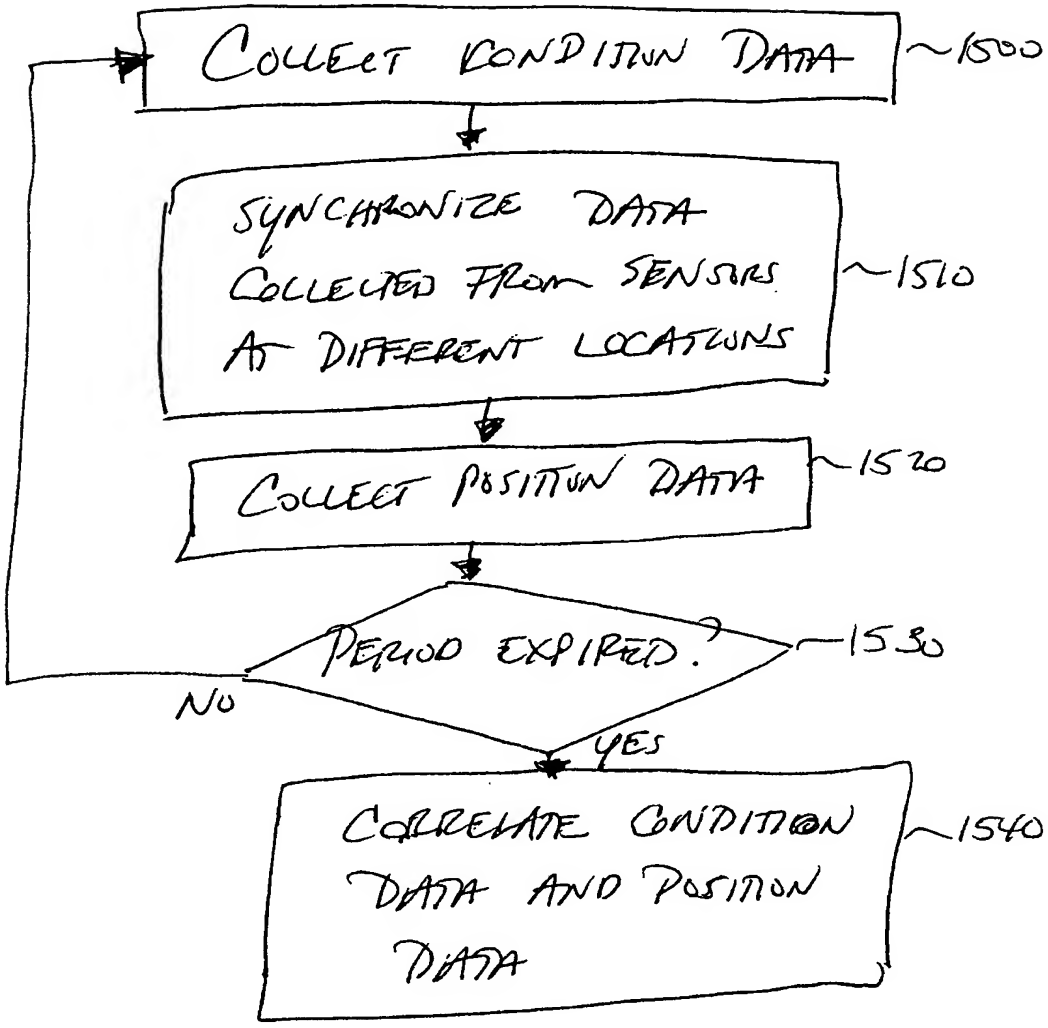

COLLECT CONDITION DATA
1500
SYNCHRONIZE DATA COLLECTED FROM SENSORS AT DIFFERENT LOCATIONS
1510
COLLECT POSITION DATA
1520
PERIOD EXPIRED?
1530
NO
YES
CORRELATE CONDITION DATA AND POSITION DATA
1540

FIG 15

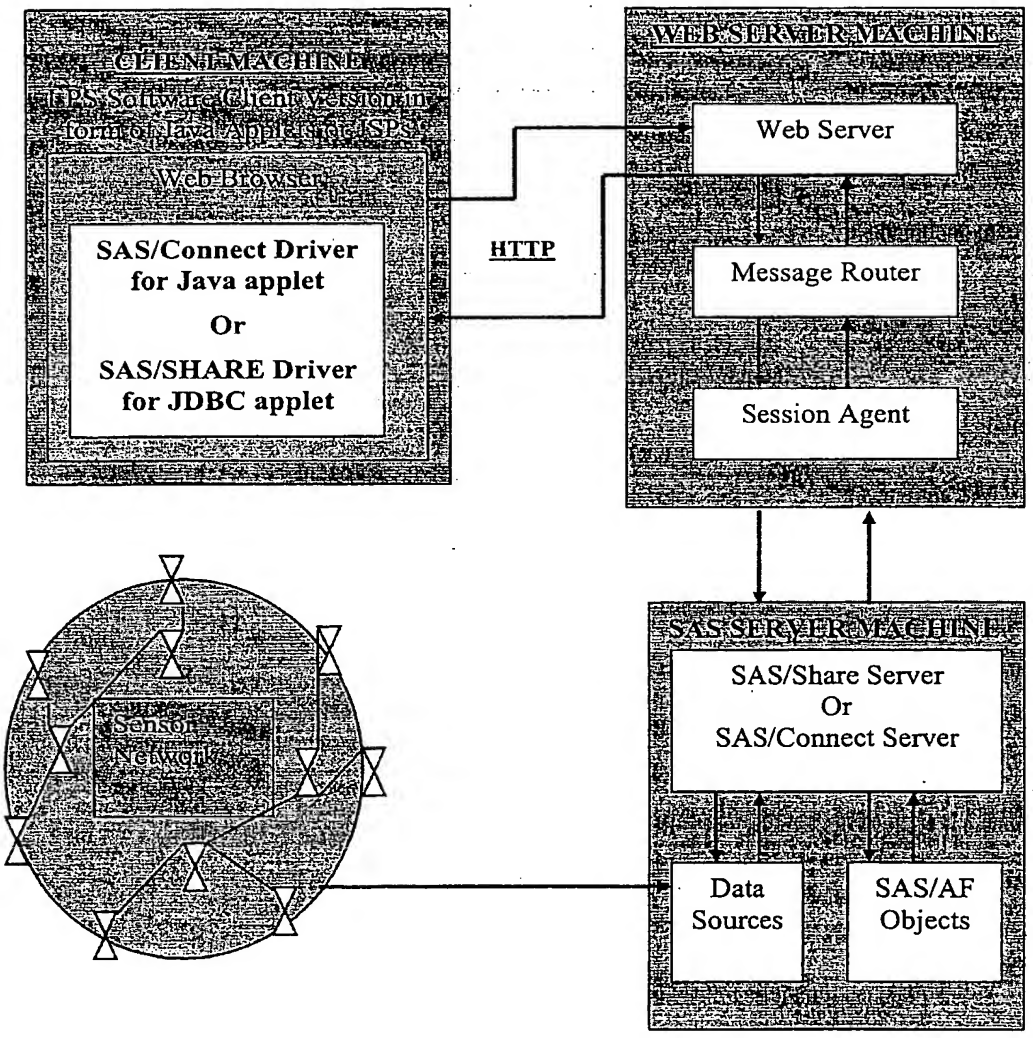

CLIENT MACHINE
ISPS Software Client version in form of a Java Applet or ISPS
Web Browser
SAS/Connect Driver for Java applet
Or
SAS/SHARE Driver for JDBC applet
HTTP
WEB SERVER MACHINE
Web Server
Message Router
Session Agent
Sensor Network
SAS SERVER MACHINE
SAS/Share Server
Or
SAS/Connect Server
Data Sources
SAS/AF Objects

FIG. 16